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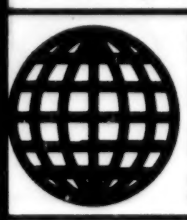

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Osaka University Develops Nano Composites

High Strength Maintained at 1300°C

95P60065A Tokyo NIKKAN KOGYO SHIMBUN in Japanese 2 Dec 94 p 6

[FBIS Translated Text] Professor Koichi Niihara of the Institute of Scientific and Industrial Research, Osaka University, and Chief Researcher Tatsuki Oji of the Structure Process Department, Government Industrial Research Institute in Nagoya, Agency of Industrial Science and Technology, have developed a nano composite material of dispersed silicon carbide about 70 nanometers in grain diameter on an aluminum oxide (alumina) crystal grain boundary of about 2 microns. Its tensile creep (gradual deformation under high temperatures) strength was about 1,000 times higher at 1,300°C than that of alumina particles. This high temperature resistant material should be useful in automobile ceramics engines.

Silicon Carbide Dispersed in Alumina

This material is unusual in that the secondary phase ultrafine particles are well arranged over the crystal grain boundary of the parent phase. Professor Niihara and his group have already developed a nano composite material of silicon carbide dispersed within the alumina crystal. And they have achieved a level of strength about twice that of silicon nitride. Silicon nitrides currently are used for various automobile component materials. This time the researchers added silicon carbide particles in the interface of the alumina crystal parent phase.

When the crystals were bent or tension was applied, air bubbles formed on the interface of the crystal and the interfaces glided up and down as well as sideways, resulting in deformation of the crystals. However, the new nano material showed that the silicon carbide particles which were arranged over the interfaces entered the alumina crystal when pressure was applied, and this prevented the surfaces from gliding.

Levels of strength 1,000 greater than that of alumina particle and 10 times that of silicon nitride were achieved by dispersing silicon carbide grains 10 nanometers each in diameter within the alumina crystal and arranging particles of about 70 nanometers each over the interface.

This material was fabricated by first adding 5 percent silicon carbide to alumina, combining the two with wet and dry blending procedures, and finally hot-press sintering the material under 50 megapascals of pressure. Alumina has been used mostly for refractory materials and is a great deal cheaper than silicon nitrides. Therefore, prospects seem bright for application in a wide range of areas, including materials for cutting tools as well as automobile parts.

Report on Kiku-6 Engine Malfunction Failure

95P60062A Tokyo MAINICHI SHIMBUN in Japanese 16 Dec 94 p 7

[FBIS Translated Text] A Sub-Committee of the Space Activities Commission (SAC, Chairman: the Science and Technology Agency (STA) Director-General Makiko Tanaka) on 15 December reported to the SAC results of its investigation of the Engineering Test Satellite "Kiku-6" failure. The National Space Development Agency (NASDA) failed to place the Kiku-6 in geostationary orbit in August 1994. The report concluded that the failure was caused by a defective fuel valve in the small engine designed for changing orbits. However, it was an unusual problem that was difficult to predict in advance, and therefore, further investigation will be required to pinpoint blame.

The Kiku-6's small engine at first failed to generate the anticipated one-tenth power output because the fuel valve did not open properly. NASDA decided then to send command signal to fire the engine repeatedly hoping that the situation would return to normal. Then, however, the valve became stuck open and fuel kept flowing. As a result, the plan to enter geostationary orbit had to be aborted.

The Sub-Committee concluded after investigation of the production plant that the failure was caused by the spring on the fuel valve sliding about 0.5 millimeters out of place through vibration during flight and getting stuck inside, resulting in the improper opening. In addition, the oxide film on the surface of the components that serves as a lubricant came off, resulting in high friction.

Under these circumstances the engine firing was repeated and the valve stopped closing due to one of the following reasons: 1) the piston did not return to its original place due to friction; 2) a small amount of liquid fuel froze and plugged the pipe which controls the opening and closing of the valve.

During ground tests prior to launch, this valve normally operated under conditions more severe than those actually encountered in space. However, the latest ground re-testing proved that the spring slid too far out of place through slow vibration under conditions approximating the space environment. The Sub-Committee concluded that it was a very unusual problem which could not have been predicted beforehand on the ground. Therefore, NASDA inevitably decided to try to correct the situation through repeated firings.

Meanwhile, the Sub-Committee made suggestions that included measures be taken in the future to improve ground testing under conditions that more closely approximate the space environment. The Sub-Committee in collaboration with the STA and SAC will continue to pursue responsibility for the failure.

Construction of Wind Tunnel in Hokkaido

JDA Decides on Kawasaki Heavy Ind as Prime Contractor

95P60062B Tokyo NIKKAN KOGYO SHIMBUN in Japanese 24 Oct 94 p 17

[FBIS Translated Text] The Japan Defense Agency (JDA) has decided to use Kawasaki Heavy Industries Ltd. (KHI, President Hiroshi Oba) as prime contractor to construct a "Three Level Sonic Velocity Wind Tunnel System," which can test and evaluate aerodynamic properties of aircraft and missiles at JDA's major practice field in Hokkaido in FY95. Six hundred million yen has been earmarked for the first year to construct the system which connects a high pressure air source with an air storage tank. After FY96, construction of the system's peripheral facilities will take place in steps. Its operation is expected to begin in FY2001. It is expected to cost a total of over 10 billion yen.

The three level sonic velocity wind tunnel system can check various properties in at 3 levels of the velocity of sound, including the subsonic, transonic, and supersonic bands. The system can test and evaluate aerodynamic properties of airframes at the facility required for the development and production of prototypes for aircraft and missiles.

The system will be part of the "Aerodynamic Propulsion Research Facility" which is under construction at the Hokkaido Major Practice Field. The system will consist of a "Combustion Wind Tunnel," which can test and evaluate capability and performance of engines for missiles of the future and the aerodynamic properties of artillery shells, an "Engine High Performance Testing Device," which tests and evaluates aircraft engine performance on the ground, and the latest "Three Level Sonic Velocity Wind Tunnel System." Mitsubishi Heavy Industries Ltd. and Ishikawajima-Harima Heavy Industries Ltd. already have been granted contracts from JDA and began construction in FY92 on the combustion wind tunnel and the engine high performance testing device respectively. Now that KHI has been officially granted the contract based on its reputation for wind tunnel technology, construction efforts for all of the equipment intended to be included in the aerodynamic propulsion research facility are fully under way.

JAEI Applies Fiber Optic Serial Interface Module to Fly-by-Light

Specifications to Be Included in World Standard

95P60062C Tokyo NIKKEI SANGYO SHIMBUN in Japanese 24 Oct 94 p 12

[FBIS Translated Text] The Japan Aviation Electronics Industry, Ltd. (JAEI) has commercially applied a high performance fiber optic serial interface module (FOSIM) to fly-by-light for aircraft. FOSIM can transmit information accurately even under severe environmental conditions, including high temperatures and vigorous vibration. JAEI has proposed to include the product specifications in the world ARINC standards for on-board aircraft equipment, and expects approval before the end of 1994. It is extremely rare to have the proposals of Japanese manufacturers accepted.

The commercial FOSIM is connected with optical fibers which serve as a data bus for information transmission through fly-by-light. The receiver converts optical signals to electric signals and the transmitter converts electric signals to optical signals. Both receiver and transmitter measure 50 millimeters in length, 25 millimeters in width, and 6.8 millimeters in thickness.

When a pilot operates a control stick, for example, optical signals are transmitted through fibers to become electric signals using FOSIM. These electric signals are transferred to integrated circuits called the controller which moves the wings.

FOSIM requires high resistance to high temperatures and vibration because it is located near the engines. It operates normally at above 120° C and below 50° C. Five hours of testing also was successfully conducted for triaxial vibration.

When strong and weak signals pass close to and above the data bus, the weak signals will be hidden by the strong signals. Even under those circumstances, the light-intercepting level was set for a maximum of -17 decimeters and a minimum of -41 decimeters, over 2 times wider than those of the normal light modem modulator, so that FOSIM recreates signals faithfully.

JAEI has provided a FOSIM for the fly-by-light experiments which are being conducted at present by the Boeing Co., U.S. in collaboration with commercial airline companies. The results obtained so far have that which was expected.

In addition, JAEI has proposed use of its own FOSIM for ARINC standards by the Aeronautical Radio Co. (Maryland, U.S.), virtually the worldwide standard in the field of on-board aircraft equipment.

The standards that includes the FOSIM method are expected to be confirmed before the end of 1994. However, it is necessary to price the FOSIM at around $1,000 per unit in order to popularize it in the future. Therefore, ways of reducing costs in the future with mass production in mind must be discussed.

AIST Operation Tests for HST Engines

95P60066A Tokyo NIKKEI SANGYO SHIMBUN in Japanese 13 Dec 94 p 5

[FBIS Translated Text] The Ministry of International Trade and Industry's (MITI) Agency of Industrial Science and Technology (AIST) announced on 12 November that ground operability tests had begun for the hypersonic transport (HST) engines under joint development by 7 engine manufacturers from Japan, the U.S. and Europe. The joint project aims at developing a next-generation engine which can power an aircraft to ultra high speeds of 5 times that of sound (Mach 5) and generate minimum amounts of noise and exhaust gas. A small model is being used in the operability tests to confirm basic capabilities and operability. A prototype engine will be developed by FY98 and commercialization is expected in the early 2000's.

Two types of engine, the "turbojet" and "ramjet," are being used in the operability tests. They have the major technologies for the HST engine. The turbojet is used to accelerate the speed from take-off up to Mach 3. The first small trial model that is completely configured was made for this test. Design technology will be tested for movement, vibration, and overall system strength. The ramjet then takes over in the Mach 2.5 to Mach 5 supersonic range. If commercialized, it will be the world's first such engine to be used for commercial aircraft. So far, a prototype combustor, the core of the engine, has been produced. Combustion technology will be confirmed through ground testing. The project's ultimate goal is to develop a "combined cycle engine" by combining these two types of engine. Work on the prototype engine is scheduled for completion by FY98.

The 10-year international joint research project on the HST engine was inaugurated under the leadership of MITI in FY89. The three Japanese corporate participants include Ishikawajima-Harima Heavy Industries Co., Ltd. and Mitsubishi Heavy Industries, Ltd., and the four major overseas engine manufacturers include United Technology of the U.S. and Rolls Royce of the U.K. R&D costs are estimated to reach a total of ¥28 billion.

IHI Successfully Tests TiAl Alloy Low Pressure Turbine Engine

95P60063A Tokyo KAGAKU KOGYO NIPPO in Japanese 12 Dec 94 p 10

[FBIS Translated Text] Ishikawajima-Harima Heavy Industries Co., Ltd. (IHI) has developed a titanium aluminide (TiAl) alloy, a type of intermetallic compound, and has successfully conducted tests of a jet engine that uses a prototype low pressure turbine blade made of TiAl alloy.

IHI has developed in-house a "light weight and high heat resistant" TiAl alloy as an intermetallic compound. In recent years, it has raised expectations for application in jet engines as a replacement for nickel based alloys. Newly produced components that use TiAl alloy have been made for the General Electric "CF6" low pressure turbine blade engine in the United States which will be used for commercial aircraft including the Airbus A300, Boeing B747SR, and B767.

Casting and machine works for the prototype TiAl alloy low pressure turbine blade components were completed in March 1993. Later, evaluation tests were conducted for the components, and since June 1994 endurance tests have been conducted after GE built the "CF6 engine" using the new components. In November 1994, they completed the work confirming satisfactory performance of the components.

From now on, IHI will try to improve design and production technologies and reduce the cost of production, including that of materials, thus enabling commercialization.

Titanium aluminide has a relative density of 4 grams/centimeter, about half that of nickel based alloys. Its specific strength and specific creep strength are about the same as those of nickel alloy, and its specific rigidity is higher than that of nickel or titanium alloys.

KHI Completes Construction of Dual Fairing for 3rd H2

Able To Launch Multiple Satellites

95P60051A Tokyo NIKKEI SANGYO SHIMBUN in Japanese 25 Nov 94 p 12

[FBIS Translated Text] Kawasaki Heavy Industries Ltd. (KHI) completed production of a new fairing for the 3rd H2 rocket scheduled for launch on 1 Feb 95 and delivered it to the National Space Development Agency (NASDA). The fairing, a satellite storage located at the tip of the rocket, has

a new feature which enables launch of multiple satellites into different orbits. The 3rd H2 will send a space flyer unit (SFU) into low-Earth orbit and a geostationary meteorological satellite -5 (GMS5) into geostationary orbit. The fairing for the 3rd H2 measures a maximum of 5 meters in diameter, 1 meter larger than that of the past 2 fairings. Aluminum was used for the fairing for the 1st and 2nd H2s but the 3rd one used carbon fiber reinforced plastic (CFRP) material to reduce weight. After launching, the top fairing will be separated to send the SFU out first and the rocket will continue to ascend and separate the bottom fairing to send the GMS5 into geostationary orbit.

The SFU, built as part of a joint project sponsored by the Ministry of Education and NASDA, will be recovered by the U.S. spaceshuttle in the summer of 1995. The SFU will also collect basic data for the Space Station which is under development by Japan, the U.S., Russia, Europe, and Canada hoping to operate after the year 2000. The GMS5 is the successor to the current meteorological satellite "Himawari-4" which is capable of operating for 5 years.

At present, the European Ariane-4 rocket, which has over 60 percent share of commercial satellite launch market, can also launch multiple satellites. However, the Ariane can only put them into one orbit per launch. The 3rd H2's effort to send 2 satellites to 2 different orbits is a rare accomplishment.

MHI To Modify H2's Main Engine

Production Cost To Drop by 30 Percent

95P60051B Tokyo NIKKEI SANGYO SHIMBUN in Japanese 2 Dec 94 p 12

[FBIS Translated Text] Mitsubishi Heavy Industries, Ltd (MHI) will reduce production costs by approximately 30 percent by modifying the "LE7," the main engine of Japan's large H2 rocket. Major modification efforts include reduction of the number of components and simplification of valve structure. Official design work will begin as soon as experimental engines meet performance requirements in combustion tests scheduled in the near future. The modified engine is intended to be used on the 7th H2 rocket which is scheduled for launch in FY98 at the earliest. If cost reduction efforts proceed smoothly the H2 will become more competitive with U.S. and European rockets, increasing prospects for more participation in the commercial satellite launch business.

The "LE7" generates 86 tons of thrust, the equivalent of 4 jumbo jet engines at sea level using liquid oxygen and hydrogen for fuel. Observers note that quality consciousness in pursuit of reliability may have been excessive. The National Space Development Agency (NASDA) had already begun to reduce H2 production costs with a FY94 budget allocation of approximately 1.28 billion yen entitled "revision of rocket operations."

MHI's modification plans for the "LE7" are compatible with NASDA guidelines. Components that control vibration such as "baffles" and "resonators" have been eliminated. Also the structures of various valves have been simplified. MHI will deliver the modified experimental engine and soon will begin combustion tests of about 10 seconds duration each. MHI's long-term plan includes reduction of the sections that require welding. As soon as the modified sections are proved reliable, design work on the "LE7" modification will officially begin. These modifications are intended to reduce production costs by a maximum of 30 percent.

The cost of an H2 launch, including production and fuel, currently is about 19 billion yen. This is considerably more than the approximately 9 billion yen of the European "Ariane-4" rocket which has over 60 percent of the commercial satellite launch market. These modification are not expected to be noticed in mass production for a while. Therefore, it is quite unlikely that H2 launch costs will be reduced to the Ariane level all at once.

However, there is hope for greater participation in the commercial launch market if costs can be reduced by about 30 percent through the design modification efforts.

Nissan Motor Co. To Provide Korean Company Small Truck Manufacturing Technologies

95FE0032A Tokyo NIHON KEIZAI SHIMBUN in Japanese 20 Aug 94 p 1

[FBIS Translated Text] Nissan Motor Co. and Nissan Diesel Motor Co. reached an agreement with Samsung Heavy Industries Co., Seoul, South Korea to provide Nissan's small truck manufacturing technologies to the latter, and they are expected to sign the contract by the end of August. Samsung Heavy Industries became the latest entry into Korea's automotive industry when they started mass production of large trucks this spring. The addition of small trucks to their product lineup means that Samsung Heavy Industries is now a broad range manufacturer of commercial vehicles which further suggests the possibility of their participation in the passenger vehicle market as well.

What is going to be licensed this time by the Nissan group to Samsung Heavy Industries is "Atlas," a small truck with the load capacity of 1 ton. Samsung Heavy Industries plans to manufacture the small trucks at the rate of approximately 10,000 units per year starting 1995 at their Changweon No. 2 Plant where they are currently producing large trucks.

This small truck Atlas developed by Nissan Motor is currently being manufactured in Japan by Nissan Diesel Motor under a license. Consequently, Nissan Diesel Motor is going to represent the group in the license agreement with Samsung Heavy Industries. Nissan Motor will receive a portion of the license fee from Samsung Heavy Industries.

Nissan Diesel Motor is going to export the engines and the cabs and dispatch engineers to assist Samsung Heavy Industries in the start-up period of the production. It is expected that Samsung will begin assembling the engines to increase the domestic production ratio within a few years.

Samsung Heavy Industries went into a license agreement with Nissan Diesel Motor in 1992 and began manufacturing the large trucks at the rate of 200 units a month. In less than two months after they entered the large truck market in South Korea, they succeeded in capturing over 10% of the market and has since given a profound impact on the market share chart.

AIST Establishes Chassis Dynamometer Facility for EV

95FE0032B Tokyo DEMPA SHIMBUN in Japanese 9 Aug 94 p 7

[FBIS Translated Text] A chassis dynamometer for electric vehicles is installed (see drawing) at Mechanical Engineering Laboratory of Agency of Industrial Science & Technology (see attached diagram). The equipment was developed under the auspices of the Transportation Machinery Section of its Basic Machinery Department.

While the performance evaluations of electric vehicles provide important information to the general public regarding those vehicles, it has been impossible to evaluate them correctly due to the unique problems associated with electric vehicles and to the fact that there are so many varieties of electric vehicles.

Therefore, said laboratory has decided to install a chassis dynamometer in order to clarify any application engineering problems that might occur under actual running conditions, especially in the area of the battery charge/discharge characteristic which is the determining factor of the energy efficiency of electric vehicles, and to establish an evaluation method that can express the vehicle performance accurately.

The full charge running distance that represents the distance an electric vehicle can run after a single charge and the power consumption rate that represents the energy saving rate are the most important evaluation scales for electric vehicles. Since it is necessary to determine those values under actual running conditions, it is important to be able to simulate the running conditions of electric vehicles very accurately. A chassis dynamometer for internal combustion engine vehicles can not properly address the problems unique to electric vehicles, such as the temperatures of batteries, motors and controllers, or the regenerative control.

The equipment installed at the laboratory was developed by modifying and adding certain features to a chassis dynamometer of four wheel vehicles equipped with internal combustion engines, and its major feature is the capability of accurately simulating the running conditions of electric vehicles.

It consists of:

(1) chassis dynamometer,

(2) vehicle cooling device;

(3) vehicle operating device;

(4) battery simulation device.

This chassis dynamometer is designed as a two rollers-two dynamometers type consisting of two independent roller axles for the front and rear wheels so that it can deal with four wheel drive vehicles driven by four wheel motors, a vehicle design unique to electric vehicles; it is capable of testing various types of four wheel and two wheel vehicles. Each of the two dynamometers of the equipment has an alternating current machine built into the drum in order to save the space. Also, its rear axle side uses a flywheel type mechanical inertia device in addition to the alternator to minimize the dynamometer space and improve the measuring accuracy at the same time.

Taking full advantages of this equipment, the laboratory intends to establish a simulation running method to recreate battery temperatures and charge/discharge conditions on the chassis dynamometer equivalent to actual running conditions in order to clarify the battery problems that may occur during actual operations of the vehicles through various tests simulating city driving conditions, as well as to clarify fundamental factors such as the optimum electric power measuring method and the standard simulation running test method for chassis dynamometers.

Mazda Motor Corp. Develops 2500cc-Class Diesel Engine

95FE0032C Tokyo NIKKAN KOGYO SHIMBUN in Japanese 29 Sep 94 p 19

[FBIS Translated Text] Mazda Motor Corp. developed a new 2,500cc-class diesel engine. With this development, they hope to intensify their capability of creating more recreational vehicle (RV) products whose market is rapidly expanding these days. The company plans to introduce a 1 5 box type mini-van "MPV" as the first merchandise of its class in the spring of 1995. While a fierce battle is fought among auto manufacturers in the diesel engine development race at the moment fanned by the toughening emission control regulations, at the same time, an increasing number of engines are being sold and purchased between competing automobile manufacturers as well in order to save the development costs. Mazda, for one, developed this 2,500cc-class engine suited for the use on RVs, while it decided to purchase 1,700 and 4,000cc-class engines from Isuzu. It is the first time for a Japanese manufacturer to design a diesel engine using the major components such as the cylinder block of an existing straight 4 cylinder gasoline engine to minimize the development and manufacturing costs.

It is a 2,500-class diesel engine featured with the quietness and high power characteristics suitable for passenger cars as well. It is designed not only to clear the short-term emission control regulations but also to cope with the long term emission control regulations expected in late 1990s with a sufficient flexibility.

While the ratio of diesel engine-powered vehicles among all RVs is said to be close to 80, Mazda didn't have its own diesel engine up until now, which made it difficult for Mazda to compete in the market. Mazda will use this engine to power its MPV for the domestic market. Although the choice of engine for MPV is currently limited to V6 3,000cc gasoline engine, Mazda hopes to improve its standing by the addition of this new diesel engine. Furthermore, it intends to use it on the new RV being developed and make it the standard engine for that class of vehicles.

Yazaki Corp. Develops Super Precision Fuelometer for Diesel Cars

95FE0032D Tokyo NIKKEI SANGYO SHIMBUN in Japanese 26 Sep 94 p 12

[FBIS Translated Text] Yazaki Corp. has developed a precision fuelometer that monitors the fuel consumption rate and displays it continuously on a device located close to the driver's seat of diesel engine-powered motor vehicles such as trucks and buses. The company claims that this will help the users to monitor the fuel consumption of each vehicle and cut down unnecessary fuel consumptions, as well as to detect engine troubles in earlier stages. The company hopes to sell 10,000 units a year helped by the needs for better fuel consumption rate in the land transportation industry as its profit margin has been shrinking due to the toughening of regulations by the authorities such as the overloading control.

The newly developed instrument measures the fuel flow rate on a real-time basis using a high precision flow rate sensor built into the fuel line between the diesel engine and fuel tank, and displays the measurement result on a display. With the help of this instrument, the driver can be aware of the vehicle's fuel consumption rate continuously with an accuracy of plus/minus 2 percent. By switching the measurement mode, it can display either the accumulated consumption, trip consumption, fuel flow rate or consumption rate of the vehicle.

Since the computer records the fuel consumption rate for each driver with the accuracy of 10cc, the managers of transportation companies can find in early stages bad drivers who have the habit of keeping engines idling unnecessarily or driving vehicles wantonly. The instrument is also of warning the drivers while driving against wanton driving which results in a poor fuel consumption rate.

It can also be used to calculate the average fuel consumption for each vehicle. The analysis of such a data should provide a means of judging the engine condition. It also helps to reduce exhaust emission. The unit price is ¥140,000.

The transportation industry has a keen interest in improving the fuel consumption rate of diesel engine vehicles as a result of the poor profitability caused by an increase in the light oil tax introduced at the end of last year in addition to the reduction of the business volume. Therefore, a strong demand for the new fuelometer is expected.

Sankyo Co. Finds New Treatment That Could Lead to New Drugs for High Blood Pressure

43070009A Tokyo THE NIKKEI WEEKLY in English 14 Nov 94 p 5

[FBIS Transcribed Text] A recent finding by Sankyo Co., Japan's second largest pharmaceutical manufacturer, could lead to new drugs for the treatment of high blood pressure and heart problems.

Sankyo has been able to isolate the gene that codes for an enzyme related to endothelin. Naturally occurring endothelins are the most powerful substances known to constrict blood vessels and raise blood pressure.

To develop a substance which inhibits the so-called endothelin converting enzyme, or ECE, which cleaves inactive endothelins into their active forms, one first needs access to large amounts of ECE. While it is possible to purify the enzyme from animal sources, research would be much more efficient if ECE could be mass produced using genetic engineering.

To do that, however, you need the ECE gene, and that's where Sankyo fits in.

Sankyo purified ECE from rat lung tissue, analyzed the enzyme's amino acid structure and deduced the base sequence of the DNA coding the enzyme.

From there, the company went back and isolated the ECE gene from rats and then from humans.

The company said the two genes share over 90% similarity.

The company inserted the rat ECE gene in monkey cells and found that the enzyme obtained retains the ability to cleave inactive endothelin.

Sankyo is now screening bacteria culture solutions for substances which inhibit the action of ECE.

Institute of Physical and Chemical Research Identifies Protein That Determines Diversity

43070017A Tokyo THE NIKKEI WEEKLY in English 7 Nov 94 p 13

[FBIS Transcribed Text]

Substance Said Crucial in Pairing of Chromosomes

New types of gene therapy and better ways to improve plant and animal species could be the eventual outcome of recent work at the Institute of Physical and Chemical Research, where scientists have identified a protein involved in making sure that chromosomes line up properly for homologous recombination.

If you recall your high school biology, homologous recombination is the fancy name for "crossing over," the time during the creation of egg and sperm cells when the chromosomes pair up and exchange odd strands of genetic information.

Crossing over is the fundamental basis to diversity; the process which keeps the gene pool well mixed.

Chromosomes are the structures in the nucleus of the cell which contain DNA, the double-stranded molecule that encodes genetic information as a varying sequence of four molecules, or bases, referred to as G, C, A, and T. The double helix structure forms because the bases are naturally attracted in pairs: G with C and A with T. This is the standard Watson-Crick model.

What the researchers at the institute determined is that during homologous recombination, a protein called RecA makes sure that the DNA molecules line up differently, with each base attracted to its own kind: A with A, T with T and so on.

Gene Therapy

The finding suggests that it may be possible for scientists to artificially control homologous recombination.

The technique could be employed for more effective gene therapy, where a gene is introduced to substitute for a faulty gene. It may also prove to be a useful tool for "knocking out" genes to investigate their function in more- advanced animals.

Japanese Universities Succeed in Gene Therapy to Suppress C

95FE0033A Tokyo NIKKAN KOGYO SHIMBUN in Japanese 5 Oct 94 p 6

[FBIS Translated Text]

Professor Toshimitsu Uede of Hokkaido University, Institute of Immunological Science and Professor Ikuo Saiki of Toyama Medical and Pharmaceutical University, Institute for Oriental Medicine succeeded in gene therapy using mice which strongly suppresses cancer metastasis. They succeeded in raising the systemic immunoreactivity and suppressing the metastasis of skin cancer to practically zero by inserting the protein (B7) gene of the immune system which elicits T-cell growth into part of the cancer which had been removed and returning it to each mouse. It seems that gene therapy can be carried out comparatively easily in humans by inserting the B7 gene into cancer cells which were removed during examination. This method is expected to be effective treatment of stomach cancer, colon cancer and even brain tumors, tumors whose complete removal is difficult. Professor Uede et al. will announce this at the Japanese Cancer Association meeting which is held at the Nagoya International Conference Hall in Nagoya from 19 October. B7 is a surface protein of cells that induces multiplication and activation of T cells which comprise the core of the immune system. Because many cancers of the digestive system, liver and brain do not have this B7 on the surface, T cells are not able to multiply sufficiently so that the immune mechanism is not manifest.

Then professors Uede and Saiki inserted a type of gene that has been demonstrated to belong to the same group as this B7 into melanoma cells of skin cancer, which readily metastasizes to the lungs, using a conventional vector.

This was transplanted via the tail vein of a mouse and the lungs were examined two weeks later.

As a result, 260 black dots were observed following metastasis when B7 was not inserted, while almost none were ascertained to be present when B7 had been inserted.

In future treatment of people, some cancer cells removed in examination would be used and transplanted subcutaneously or the genes can be inserted directly into the cancer if it is on the surface, such as skin cancer, which would reduce the burden on the patient.

The main stream of gene therapy of cancer has been to suppress cancer growth through arrangements using genes such as interferon which raise the reaction of T cells.

In contrast, attention here is paid to B7, and the suppression of metastasis, which has been a barrier in cancer treatment, is new. Furthermore, it seems that the insertion of both types of genes to concurrently suppress cancer growth and metastasis will be possible.

JICST To Begin Genome Analysis in FY95

95FE0033B Tokyo NIKKEI BIOTECHNOLOGY in Japanese 29 Aug 94 p 12

[FBIS Translated Text]

JICST Begins Genome Analysis in 1995, and Requests ¥ 260 million for Sequencing (Science and Technology Agency)

The Science and Technology Agency, which received a report presented by the Science and Technology Conference, Human Genome Council on 24 August, made an announcement at the Japan Information Center of Science and Technology (JICST) of their intention to begin the determination of the sequence of bases in the DNA field in which one million bases occur in succession (consult the separate paragraph in this journal, this number). A total of 556 million yen was budgeted in the 1995 approximate request for development of a high-level fundamental organic data base, and 260 million yen of that amount was budgeted for human genome sequencing. The amount requested is for a half year since the project is to begin 1 October 1995.

Rather than performing the sequencing itself, JICST has commissioned two teams to generate DNA base arrangement data. It will contract with one team to complete sequencing of approximately one million bases annually. At present, it costs approximately ¥ 200 to determine the arrangement of one base. In short, approximately ¥ 200 million must be budgeted to determine one million bases. In light of such circumstances, ¥ 260 million was allotted per team. A team leader has not been decided upon at present, but the researcher who has arranged material so that sequencing can be started immediately after conclusion of a contract with JICST would be selected. The teams will gradually be increased from 1996. Details, including selection of the team leader, the actual sequence organization and the content of the contract, will be clarified after completion of the 1995 budget.

However, in order to begin the project with a high level of participation by JICST in development, the law must be amended because JICST was set up as an information service institution in the Japan Information Center of Science and Technology law. The Science and Technology Agency is going to submit such a bill to the Diet by next spring, and plans to provide JICST with the functions of a research and development organization.

Makoto Konishi, Assistant Director of the Life Sciences Division, Science and Technology Agency, states the following about the organization which commissions two teams to complete sequencing of the human genome. "We selected the fastest and cheapest method to complete the sequencing of one million bases." An organization to sequence a region in which one million bases occur in succession has been rapidly organized in Europe and the United States. The report of the Human Genome Analysis Council envisions that the sequencing of 500 million bases would be completed in the entire world by the year 2000. However, Japan is just at the starting line in sequencing of the human genome, at the scale of one million bases. If Japan were to attempt to rank itself equally with the United States, France and Britain by sequencing approximately 100 million bases within five years, a total of 20 researchers would be necessary if we assume that one researcher is able to sequence one million bases annually. However, the materials for sequencing on the scale of one million bases in Japan totalled approximately 20 million bases as of the end of 1993, which represents approximately one year's worth of sequencing by 20 researchers. With the present shortage of people and material, the decision of the Science and Technology Agency that sequencing will be carried out using existing materials and facilities may be the correct one. However, in that case, the disparity between Japan and the countries of Europe and the United States will grow further. If Japan cannot compete for a while in terms of the amount of data, it should come up with new ideas which make use of areas in which Japan has superiority.

Council for Science and Technology Proposes Strong Support to DNA Sequencing

95FE0033C Tokyo NIKKEI BIOTECHNOLOGY in Japanese 29 Aug 94 p 12

[FBIS TRANSLATED TEXT] Human genome council publishes a report which emphasizes the importance of sequencing (Science and Technology Conference)

The Science and Technology Conference, Life Science Subcommittee, Human Genome Analysis Council, issued a report to the Life Science Subcommittee, which convened on 24 August, that describes the state of progress in human genome analytical research, problems at this time and future plans. Related agencies which receive this report will incorporate the budget for genome analytical research in their budget requests beginning in 1995.

The title of this report is, "Regarding immediate issues in human genome analysis." This is the second report which follows the report titled, "Regarding measures to promote human genome analysis" which was compiled by this council in August 1991. The greatest difference between the current report and the preceding report is that this one is an overall promotion of the importance of sequencing. It proposes supporting sequencing by researchers who actually retain DNA material in actual sequencing in Japan. Therefore, it states that research facilities/equipment as well as technicians engaged in comparatively simple work and research assistants, etc. should be set in place.

Kyoto University Develops Artificial Enzyme to Selectively Cut DNA

95FE0033D Tokyo NIKKAN KOGYO SHIMBUN in Japanese 9 Sept 94 p 7

[FBIS Translated Text] Professor Yukio Sugiura of Kyoto University, Chemistry Research Laboratory developed an artificial enzyme that recognizes slightly longer sequences of bases and selectively cuts them. This compound, termed a zinc finger, binds nickel complexes that generate active oxygen to proteins which bind to deoxyribonucleic acid (DNA). It is characterized by the fact that it finely cuts the base sequence like conventional DNA- cutting enzymes. This may be useful in human genome analysis and in research to cut dozens of sequences that are important in illness.

Naturally-occurring DNA-cutting enzymes that finely cut DNA are usually used in genetic engineering, but the expectation is developing that artificial enzymes would be the technique for cutting only specific DNA sequences. To that end, a means of binding to a specific DNA sequence is required. However, the conversion of a long DNA to a single chain and its handling are difficult when applying DNA complementary pairs. Furthermore, in the case of a triple helix in which one more chain is entwined about a double helix, an enzyme that can accommodate various long DNA sequences is sought since triple overlapping occurs only in specific sequences.

In response to this, Professor Sugiura focused his attention on the "zinc finger", a protein with a structure in which an amino acid chain is looped like a finger about a core of zinc. It binds naturally to DNA and acts to promote/retard DNA transcription. Such proteins, which number close to 100 types, are known to bind with individual DNA sequences.

Thus, a compound was created that liberates active oxygen when an oxide is added. It was created by appending a small nickel complex structure to the edge of this zinc finger molecule. When this compound was combined in a test tube with DNA consisting of approximately 200 bases that was derived from microorganisms, it recognized dozens of DNA bases and bonded with them, after which it was confirmed to cut only the cytosine sections nearby.

If this technique is expanded in the production of similar compounds from among hundreds of types of zinc fingers as a function of the DNA section whose cutting is desired, it could accommodate many types of DNA. In addition to producing long DNA which is necessary in human genome analysis and cutting DNA sections that are related to disease, this technique seems to be applicable to advancing genetic engineering by aiming at protein production.

Japan Tobacco To Begin Bio-Tomato Plantation in FY95

95FE0033E Tokyo NIKKEI SANGYO SHIMBUN in Japanese 21 Sep 94 p 1

[FBIS Translated Text] Next spring, Japan Tobacco Inc. (JT) will begin the first cultivation experiments by a private company of gene-spliced tomatoes in an isolated field. The company will petition the Ministry of Agriculture, Forestry and Fisheries for permission to conduct experimentation in mid-October at the earliest. This is a special tomato to which resistance to viral diseases has been imparted by inserting specific genes. Since its safety has been confirmed through hothouse cultivation, the decision was made to shift to experiments in the stage which precedes cultivation in ordinary fields. Tomatoes with a longer shelf life following the use of similar techniques have already gone on sale in the United States, so research in Japan must also be accelerated.

A tomato which does not contract diseases caused by the cucumber mosaic virus (CMV) has been improved by JT through gene splicing technology. It is being cultivated in a hothouse of the Genetic Breeding Laboratory in Toyodacho, Shizuoka Prefecture. This tomato has the usual reproductive capacity of ordinary tomatoes and poses no danger of weed-like spread. It has been confirmed to be free from toxic ingredients. Accordingly, the decision was made to cultivate these tomatoes in a field which is merely enclosed a fence. The field is within the Genetic Breeding Laboratory and the scope of tomato cultivation is anticipated to be approximately 100 square meters.

Once a tomato becomes infected with CMV, the leaves contract, growth stops and the plant does not bear fruit. Since the gene known as satellite RNA (ribonucleic acid) suppresses the propagation of CMV, JT incorporated this gene in tomato genes and confirmed that the resulting tomato was resistant to CMV contraction. Since CMV had been spread using aphids as a vector, insecticide had been used until now, but the need for insecticides is eliminated by the use of this new variety which enables cultivation costs to be lowered.

Gene-spliced tomato by JT.

Resistance to CMV heightened.

Cultivation experiments of gene-spliced tomatoes in ordinary fields were carried out by the National Institute of Agro-environmental Sciences, the National Institute of Agrobiological Resources and the National Agriculture Research Center beginning in 1992. The tomato was one which is resistant to the tobacco mosaic virus.

In the United States, a tomato with longer shelf life, which is picked after turning red, as a result of using gene-splicing technology by Calgine Corp. (California) went on sale in May of this year, and research by private companies in Japan has been behind.

Fujitsu Develops Technology To Clean ICs Using Water

43070008A Tokyo THE NIKKEI WEEKLY in English 14 Nov 94 p 5

[FBIS Transcribed Text] Metal contaminants which lower the performance and endurance of integrated circuits can be removed from the surface of silicon substrates with nothing more than pure water, according to a report from Fujitsu Ltd.

The find is good news for the environment, since hydrochloric acid and sulfuric acid are currently used. And it is also good news for IC makers as the process eliminates worry about proper concentrations and simplifies the cleanup of waste liquids.

In the method, pure water is first treated to reduce the oxygen concentration from 8 parts per million to 1 part per billion, and then heated to the boiling point. The silicon substrate is then immersed in this boiling water for a period of 30 minutes. During the boiling process, care is taken to keep out oxygen from the air.

Fujitsu has confirmed that this treatment reduces by 1,000-fold the presence of nine types of metal contaminants on the surface of a silicon substrate, including aluminum, copper, iron and manganese.

Japanese Companies Develop Technology to Improve Dry Cleaning Using Ozone

95FE0060A Tokyo NIKKEI SANGYO SHIMBUN in Japanese 16 Sep 94 p 13

[FBIS Translated Text] Ebara Corp., and Hakuyosha Co., jointly developed a device called "DC-1" that uses highly concentrated ozone to improve the cleaning ability of petroleum-based dry-cleaning solvents. The ozone causes dirt and grime in the solvent to coalesce, and the solvent's cleaning ability is maintained even after repeated use because the device uses a filter and activated carbon to regenerate solvent more efficiently. Ozone can also break down water-soluble grime, which is hard to deal with in dry cleaning. Declaring that the device will lead to lower running costs because it saves labor—rewashes and claims will decrease—the companies will sell 200 units per year to dry-cleaning stores.

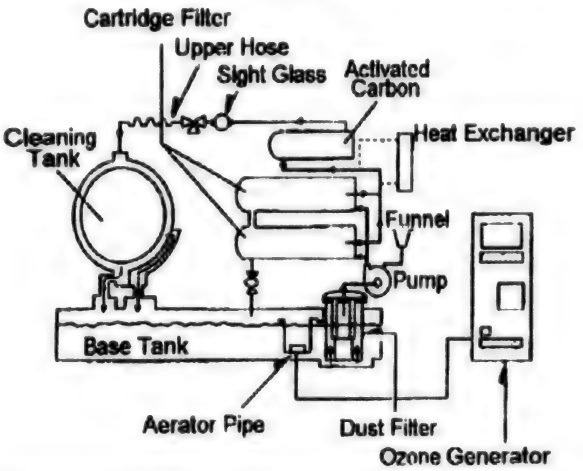
The DC-1 is a device that blows high-concentration (maximum 1.7%) ozone into the petroleum-based solvent after it is used. When the ozone dissolves, oily grime in the solvent coalesces and precipitates. In a small-scale facility such as a dry-cleaning store, used solvent is regenerated by a filter and activated carbon and then re-used. Ozone processing, however, prevents loss of solvent cleaning ability and improves the rate at which the solvent removes dirt and stains.

When tests were performed with solvent that had been used for cleaning an accumulated total of 3,700 kg of laundry, the dirt and stain removal rate was 2.1% in the case where no ozone was injected and the solvent was regenerated by means of only a filter and activated carbon. On the other hand, when ozone was continuously injected, a removal rate of 48.2% was maintained. In addition, because of ozone's deodorizing effect, fishy or meaty odors can be removed.

Commercialization of the DC-1 resulted from the combination of Ebara Corp.'s technology for generating high-concentration ozone and Hakuyosha Co.'s dry-cleaning know-whow. The Hakuyosha plant will not introduce the device because it is equipped with facilities for distilling used dry-cleaning solvents.

One DC-1 costs ¥2,450,000 and corresponds to a dry-cleaning device with a processing capacity for 38 kg of dry laundry. The device consumes 0.8 kW of single-phase 200-V electricity. The outer dimensions are 40 cm wide, 120 cm high, and 52 cm deep. Installation involves simply connecting the teflon pipe attached to the aerator tube.

Example of Ozone Introduction in a Dry-Cleaning Device



Of the 35,000 or so dry-cleaning devices in Japan, 70% use petroleum-based solvents. However, there is a trend in the cleaning industry to use perchloroethylene and freon solvents, which have greater cleaning ability than petroleum-based solvents. Organochlorine compounds such as perchloroethylene have been shown to be carcinogens, and the decision has been made to totally abolish certain freons by the end of 1995. Ebara Corp., sees an expanding demand for petroleum-based dry cleaning, which will open the route to sales of its dry-cleaning device.

Fujitsu Develops Technology to Remove Impurity Metal from Silicon Substrates Using Pure Water

95FE0060B Tokyo NIHON KEIZAI SHIMBUN in Japanese 24 Oct 94 p 17

[FBIS Translated Text] Fujitsu confirmed that impurity metals on the surface of a silicon substrate can be removed by pure water alone. Such impurity metals become a factor that reduces the performance and durability of LSIs. Until now, hydrochloric acid and sulfuric acid were used to remove impurity metals, but adjusting the concentration, processing the waste solution, and so on involved considerable time and labor. Using pure water solves those problems. Fujitsu regards the technology as a way to simplify the LSI production process, as well as an effective environmental measure, and will rush to make the technology practical.

The new method of removing metals uses pure water containing 1 ppb of oxygen that is formed when regular distilled water containing 8 ppm of oxygen is passed through a filter while the pressure is reduced to about 0.03 atm. That water is brought to a boil at 100°C, then silicon substrates are submersed in the water while it is kept in a state so that the oxygen in the air within the water does not dissolve.

Experiments with silicon substrates contaminated with nine different metals, including aluminum, copper, iron, and manganese, confirmed that the removal rate was highest when the water boiled for 30 minutes at 100°C and that the metal concentration on the silicon substrate decreased to one-thousandth. That is the same effect as that achieved in the processing of silicon substrates with hydrochloric acid.

In observations after the metals were removed, oxide films as thin as 3 nm that covered the silicon surface were also removed. Because of that Fujitsu researchers think that metals distributed in atomic form throughout an oxide film can be removed along with the oxide film.

Fujitsu researchers say that circulating the pure water while it boils may further improve the removal efficiency. In addition, because the metal removal can be done at the same time that the oxide films are peeled off, which is one of the processes in LSI fabrication, the new method is also useful in simplifying the manufacturing process. Assuming that the method will become practical, Fujitsu will work toward improvements.

Toray Industries Develops Technology to Separate, Recover Chlorine Solvent Vapor

95FE0060C Tokyo NIKKEI SANGYO SHIMBUN in Japanese 18 Oct 94 p 1

[FBIS Translated Text] Toray Industries developed technology to separate and recover chlorine solvent vapor by means of compound hollow-thread films. Solvents such as methylene chloride are used to clean electronic parts and machine parts in accordance with regulations on freon usage, but they vaporize easily, and concerns have been voiced about their link to environmental contamination. Toray Industries developed a durable compound hollow-thread film that is highly selective with respect to those solvents so that a high recovery rate is obtained. Now that the basic technology is established, the next step is to repeat a number of evaluation experiments for various cases and to explore the marketability of the technology.

The films that form the heart of the technology for separating and recovering chlorine solvent vapor have a compound structure consisting of an ultrathin 0.1-micron-thick silicon film layer and a polyacrylonitrile supporting film layer with numerous microscopic holes. The inner diameter of the film is 350 μm, and the outer diameter is 435 μm. About 2,500 strands of the film are packed inside a cylindrical container made of nylon resin; the cylinder has an inner diameter of 52 μm and a length of 450 mm. Both ends of the cylinder are sealed with a fluoropolymer to form a module. The films, container, and sealing material are resistant to solvents and can withstand practical use.

A gaseous mixture of air and chlorine solvent vapor is blown into the hollow threads of a module; the chlorine solvent vapor is allowed to selectively pass through to the outside of the film by the negative pressure of a vacuum pump. Then, the chlorine solvent vapor is led to a cooler where it condenses and is recovered as a liquid. The amount of chlorine solvent vapor that is recovered depends on the pressure of the vacuum pump. For example, at 0.1 atm, 90% or more of methylene chloride is recovered. There is the same effect with trichloroethylene and perchloroethylene. Tests show that the high performance of the compound hollow-thread film—the penetration speed of methylene chloride vapor reached 1,000 times that of nitrogen—has never been attained with conventional separation films.

Toyota Motor Corp. Develops Highly Efficient Separation Technology for Cutting, Cleaning Solvent

95FE0060D Tokyo NIKKEI SANGYO SHIMBUN in Japanese 24 Oct 94 p 1

[FBIS Translated Text] World Chemical Co., which manufactures and sells pumps for chemicals, and Toyota Motor Corp., jointly developed a device that doubles the life of cutting and cleaning solvents used in the machining of parts. Such solvents are usually re-used only a few times because they become mixed with substances such as oil for preventing corrosion of the machine tool. Waste water containing such solvents has been processed as industrial waste. When the new device is used, about 95% of the oil content of the waste water is recovered so that the solvent can be used again. First, the device will be sold for use in Toyota's parts plants, then gradually it will be marketed to other car makers' plants.

In the processing of parts with machine tools, a cutting liquid is applied during the cutting process, then the part is washed with a cleaning liquid. At that time, however, rust-preventing oil and chips get mixed in with the cleaning liquid. Because bacteria multiply in the oil floating on the surface and cause it to putrefy, the liquid is often discarded as waste water after it has been used a certain number of times.

The oil-separating system developed by World Chemical consists of a pump and two floats incorporated into a single device. The device floats above the surface of the cutting or cleaning liquid so that the pump's suction opening is held with a range of 3-5 mm away from the surface; only the oily matter floating on the surface of the liquid is sucked away.

The oily matter removed by the pump is poured into the first separation tank (45-liter capacity), where the oil separates from other substances in about 10 minutes because of the differences in specific gravity. The oil is separated again in a second separation tank over a period of several days. Finally, the oil is put into a drum and discarded. The water that was separated is returned to the original liquid. In the tests performed by World Chemical, researchers separated out oil with a water content of 1.03% and were able to recover about 95% of the oil floating on the surface.

The pump is shaped like a screw so that the device will not become clogged with chips or other such large pieces. Using the device once every day for a few hours will nearly double the life of a cutting or cleaning liquid, which ties in with environmental conservation and also helps to reduce the

bad odors that come from the waste water. The price, which depends on the processing capability, starts from ¥ 480,000. The sales target for the first year is 3,000 units.

One method of separating contaminants from cutting and cleaning liquids that has been employed for some time uses a metallic-fiber belt. The belt is submerged in the cutting or cleaning liquid, and the oily matter and chips adhere to the belt; the contaminants are then scraped off the belt with a sharp blade. With that method, however, the recovery rate is poor, and the belt and blade wear down quickly because they are easily nicked.

Toyota Motor Corp., uses about 130,000 tons of cutting liquid per year.

Clean Japan Center To Research Technology to Recover CFC, HCFC

95FE0060E Tokyo NIKKAN KOGYO SHIMBUN in Japanese 8 Sep 94 p 2

[FBIS Translated Text] According to the Ministry of International Trade and Industry, the "Freon-Refrigerant Recycling Center" (3-5-8 Shibakoen, Minato-ku, Tokyo; N. Yokota, director; telephone: 03-3432-1671) completed a demonstration plant that distills and purifies freons, or chlorofluorcarbons (CFCs), and will start CFC recycling on 12 September. The Freon-Refrigerant Recycling Center has been commissioned by the New Energy Development Organization (NEDO) to research and development technology to recycle CFC refrigerants. The demonstration plant is the first plant in Japan that recycles CFC refrigerants by recovering and distilling the refrigerants. For the time being the plant will recycle specific CFCs, R12 and R502, but later it will also recycle R22, which is a CFC substitute (HCFC).

The Freon-Refrigerant Recycling Center was jointly established in October 1993 by the Japan Refrigeration and Air-Conditioning Industry Association (chaired by T. Kitaoka, president of Mitsubishi Electric Corp.) and the Japan Refrigeration and Air-Conditioning Equipment Industry Association (chaired by M. Sugo, president of Kogyoshokai Co.). In April 1994, the Japan Freon Gas Association (chaired by J. Fuijioka, vice president of Mitsui Dupont Fluorochemical Co.) joined the center. NEDO will invest a total of ¥ 400 million in a three-year project at the center. The project, which started in FY93, involves the evaluation and selection of new methods of analyzing the components of recovered CFCs, and research on CFC recycling technology.

NEDO will commission the Clean Japan Center (CJC) with the R&D work, and the CJC will conduct joint research with the Japan Refrigeration and Air-Conditioning Industry Association. For that research an ¥ 80-million CFC distillation and purification plant will be built within the Create Co. (Kurihashi-machi, Kitakatsushika-gun, Saitama Prefecture), which is involved in CFC recycling. Plants authorized by the center will be eligible for CFC-refrigerant recycling service. There are now 320 plants authorized by the center for that service.

Matsushita Develops Recyclable Cleaning Solvent for Printed Circuit Boards

95FE0060F Tokyo DEMPA SHIMBUN in Japanese 20 Oct 94 p 1

[FBIS Translated Text] The Environment and Energy Laboratory (led by Nobuyuki Ito) at Matsushita Electric's Research Headquarters developed a distilled-water, glycol-ether cleaning agent for printed circuit boards. The new cleaning agent has the same cleaning power as specific chlorofluorocarbons (CFCs) and trichloroethane and can be distilled and recycled. Without using surfactants, which were mixed in with CFC-alternative cleaning agents in the past, the new cleaning agent can remove both oily and water-soluble contaminants. It also can improve the reliability of insulation and can be recycled, which was difficult with CFC-alternative cleaning agents of the past. The new cleaning agent can be used by simply adding distillation and recycling equipment to existing equipment for CFC-alternative cleaning agents. Matsushita is already using the new cleaning agent to remove flux from printed circuit boards at Matsushita Electronics Parts' Ceramic Division, the Matsushita-Nitto Electric Plant, the Fukui-Matsushita Electric Plant, and Matsushita Electric Industrial's Electric Motor Division. In the future, Matsushita will introduce the new cleaning agent to companies in the Matsushita Group.

Production and sales of the cleaning agent, whose product name is the "PS Series," are handled by Daiichi Seiyaku Co., which will also market the product to companies outside of the Matsushita Group. The price—¥ 1,400 per kilogram—is about the same as that for inorganic-alkali, organic-alkali, and neutral-alkali CFC-alternative cleaning agents. For the time being, Matsushita yearly sales target is 400 tons.

The new cleaning agent for printed circuit boards is made of a glycol-ether compound. By controlling alkylene glycol and alkyl structures and molecular weights, Matsushita researchers did not have to resort to mixing the cleaning agent with a surfactant. Even so, the new cleaning agent can simultaneously remove oily and water-soluble contaminants.

Because it has a simple composition that does not contain a surfactant, the range of temperatures over which the cleaning agent boils is very narrow—220°C plus/minus 5-10°C—which enables recycling by means of distillation.

Recycling CFC-alternative cleaning agents up until now has been difficult because of their complex compositions into which a surfactant was mixed.

In addition, a bit of a conventional CFC-alternative cleaning agent left on a printed circuit board affects the reliability of the board's insulation. The new cleaning agent, however, improves the reliability of the board's insulation. Matsushita researchers confirmed that, even if some of the cleaning agent remains on the board, the initial resistance value can be maintained.

Having confirmed that the new cleaning agent has almost no affect on resins, which had been a problem with conventional CFC-alternative cleaning agents, Matsushita researchers believe that the new cleaning agent can be used to clean metals and resins, in addition to printed circuit boards.

NEC Develops System for Evaluating Environmental Impact of Various Products

95FE0060G Tokyo '94 SYMPOSIUM ON ENVIRONMENTAL ENGINEERING in Japanese 1 Jul 94 pp 166-169

[FBIS Translated Text] Innovative companies recognize the importance of addressing environmental issues in the earliest stages of production. NEC's environmental total solution systems were developed for achieving eco-efficient design, and are based on life-cycle concepts. After providing an overview of the environmental total solution framework, this paper presents the software package designed to facilitate and support the development of environmentally conscious products.

1. Introduction

As is clear from the trends in ISO standardization of environmental labeling and Germany's regulations on discarded electronic and electrical equipment, "consideration of the environment," like performance and price, will continue to be an increasingly important factor in a product's competitive power. As exemplified by the keywords "reducing environmental impact," there is a wide range of environmental problems that pertain to products. For that reason, a more systematic approach that is different from the approaches taken thus far (the subjects of pollution problems of the past were clear) is needed in order to solve those problems efficiently.

We propose an "environmental total solution" as the future environmental strategy in companies. Our environmental total solution "looks at environmental problems from a wide range of viewpoints, provides solutions to those problems with integrated technology," and offers a methodology for tackling environmental problems.

This paper clarifies the concepts of environmental total solution through assessments of the environmental impact of actual products. In addition, it introduces "software for eco-product design" that NEC developed as one of the components of the system.

2. Environmental Total Solution

2.1 Evaluating the Environmental Impact of Notebook Computers

We used notebook computers from various companies (N1-N6) to evaluate the environmental impact of such computers from the viewpoint of our "environmental total solution." Figure 1 shows how much the components of the notebook computers account for in the total weight of the computer. The weight of a computer is about 3 kg. In comparison with a desktop computer, a notebook computer's plastic housing accounts for a high percentage of its weight. In addition, because it is a portable computer, the battery accounts for 20-30% of the total weight.

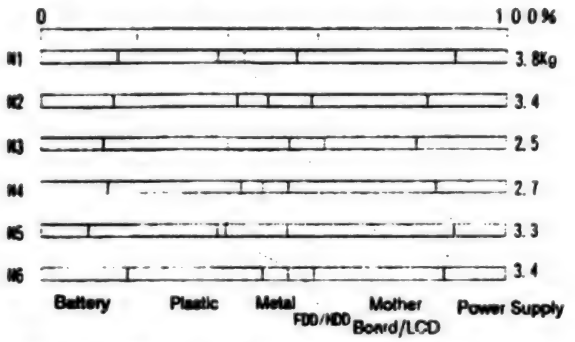


Figure 1. Characteristics of Six Portable Computers

Figure 2 gives an overview of the evaluation. The evaluation extends from the time the product goes on the market to the time it is discarded. After a discarded computer is taken apart, the battery and LCD are salvaged, the electronic circuit boards and other such parts are sent to a landfill or are incinerated, and the plastic material of the computer housing is recycled. The evaluators consisted of experts in the areas of design, EMC (electromagnetic compatibility), structure, chemical analysis, and materials. Figure 3 shows the details of the evaluation items. Items 1 to 3 are the "product's impression" and "reliability"; Items 4-8 are directly related to the "environmental impact of the product." An example of the results of the evaluation is shown in Tables 1 and 2.

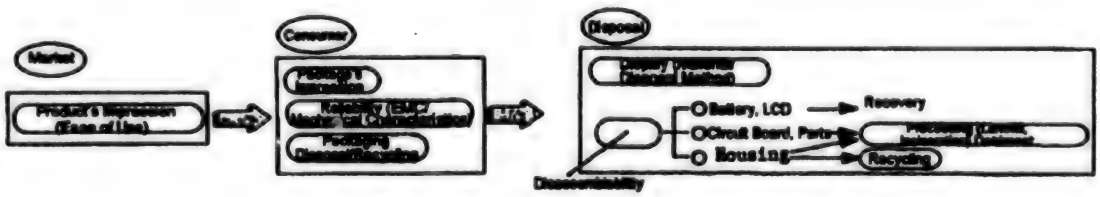


Figure 2. Life-Cycle Approach for Evaluating Environmental Impact

Figure 3. Evaluation Items for Portable Computers

1. Impression of product	5. Product's environmental labeling
A. Product's impression	A. Main body, B. Manual
B. Ease of use	C. Battery, D. Plastic housing
2. Impression of packaging	6. Good disassemblability (is the structure simple?)
A. Impression of package box	A. Disassembly time (seconds)
B. Impression after opening package	B. Disassemblability (disassembly time/number of parts): (seconds/part)
3. Reliability	C. Time needed to remove battery (seconds)
A. Packaging: cushioning effect (height 10 cm)	D. Number of screws used
B. Housing: strength of LCD panel	7. Recycling the housing
C. Electromagnetic waves: measurements of electrical field of emitted interference waves	A. Compound?
4. Disposal/recycling of packaging materials	B. Plating or paint?
A. Amount of plastic used (including foam material)	C. Number of insert nuts to be removed
B. Indications relating to disposal/recycling	D. Injection molding conditions
C. Cardboard recycling	E. Bending strength of recycled parts
	8. Harmful substances at time of burial in landfill or incineration
	A. Amount of harmful substances (qualitative evaluation)
	B. Dissolved substances (qualitative evaluation)

Table 1. Disassembly Time for Portable Computers

	NL (61 computers)	N2 (40)	N3 (39)	N4 (53)	N5 (41)	N6(39)
Disassembly time (seconds)	1080	730	720	1380	1000	940

Table 2. Recycling the Plastic Computer Cover

	Type of Resin	Short-Fiber Filling	Paint, Plating	Number of Insert Nuts	Recyclability
N1	ABS	X	Yes	9	X
N2	PC	X	No	17	O
N3	PC	X	No	15	O
N4	ABS	O	Yes	36	X
N5	ABS	X	Yes	17	O
N6	ABS	X	Yes	35	X

Table 1 compares disassembly times. The times shown were determined by filming the disassembly work that involved only manual work (no power tools) and subtracting from that the time during which the disassemblers were idle. A notebook computer takes more than three times longer to break down than a desktop computer (about 300 seconds). That is because the display is incorporated into the product so there are many parts, and the structure is complex, with many parts squeezed into a small space. The table shows the number of screws used, but, unlike the case of a desktop computer, no clear correlation is seen between the number of screws used and the disassembly time. The complex overlapping of parts becomes a hindrance in removing screws and other connections and in removing parts, and is thought to be the factor that increases the amount of time needed for disassembly. In this type of product, making the structure on which the parts are mounted a simple one is important (i.e., reducing the number of overlapping parts).

Table 2 shows the results of evaluations related to the recyclability of the computer housing (Figure 3, Item 3, except for Sub-item C). Depending on the product, differences were seen in the types of resins, whether or not the housing was a compound structure, and whether or not there was paint or plating. To remold the housing, we removed the insert nuts from the housing, pulverized the computer cover with a grinder into pellets 5 mm or smaller, then used an injection molding machine (Japan Steel Works; N40-BII) to remold the resin. We evaluated the recyclability from the tensile strength characteristics of a test strip that we had remolded. For those samples whose tensile strength dropped 10% or more below that of the

original material, we judged the computer cover as non-recyclable (i.e., an "X" in the column). It is clear that there are differences in recyclability even among the same types of resin. The selection of the material and the processing in the product stage (joining the parts of a compound structure, painting and plating) clearly have a significant effect on the recyclability.

We rated each evaluation item on a score of one to five and displayed the results in a radar chart. Figure 4 shows the results for the product that gained the highest rating (the N3 product). We see that the "attractiveness of the product" and "reliability" can be compatible with environmental consideration.

Figure 4. Environmental Impact of N3 Portable Computer

2.2 Reducing the Environmental Impact of the Product

In order to lessen the environmental impact of a product, the following issues should be dealt with from now on.

1. Environmental Measures Based on Integrated Technologies

Related to the recycling and disposal characteristics of the computer housing are the type and amount of resin, whether or not the housing is a compound structure, whether or not it is painted or plated, and the processing to make it fire-resistant. Various technical studies—design, EMC, material, structure—are needed in order to efficiently improve those characteristics. In our evaluation there was a product whose housing was superior in terms of design, EMC characteristics, and recycling and disposal characteristics (N3). That is assumed to be the result of the integration of technologies.

In order to integrate product development and technologies relating to environmental measures, the mutual sharing of information is essential, and an information network will have to be constructed.

2. Clarification of the Product Concept

The products we looked at are expected to be used as "mobile computers," and all are equipped with a ni-cad or other such rechargeable battery. However, in evaluations of actual products (Figure 3, Item 1), the size, weight, or shape of the battery was inappropriate for a mobile computer. Considering the magnitude of the environmental impact that batteries have, companies must look into offering a rechargeable battery as an option. From now on companies will have to clarify their product concepts and assume an attitude where they will eliminate any unnecessary parts.

3. Dealing with Environmental Measures from the Design Stage

From now on, in order to efficiently develop products that will have a small environmental impact, the kinds of analyses and evaluations that we have conducted will have to be done in the design stage. The development of tools for analyzing and evaluating disassemblability and recyclability in the design-drawing stage will become an important issue.

4. Understanding Environmental Problems from a Broad Point of View

The items shown in Figure 3 do not cover all of the types of environmental impact that a product can have. For a wide range of impact items, a life-cycle assessment (LCA) that enables quantitative evaluations, and other such evaluation methods will have to be introduced.

5. Raising Consciousness About Environmental Problems

From the environmental measures that have been implemented, there were many examples where a company's "view toward the environment" cannot be seen. For example, a company takes recycling into consideration and provides ISO labeling (about recycling) for the plastic material, but the company uses plating or paint and insert nuts that become a problem at recycling time. The company does not implement measures based on the assumption that the product will actually be recycled. The various types of environmental labeling are supplementary measures that are to be combined with actual measures to bring out the best effects. There is a need for the kind of measures that raise the environmental awareness of all of a company's employees.

The system for solving those issues is the environmental total solution.

2.3 Environmental Total Solution System

Figure 5 shows the concept of environmental total solution. The heart of the system is the "environmental information system," which consists of software for analyzing and evaluating disassemblability and environmental impact; an environmental database; and an information network (Figure 6). The design, development, production, and research departments use the environmental database to evaluate a product's disassemblability, recyclability, problems at disposal time, environmental impact of the materials and parts used, etc. Those departments also can utilize the information network for "discussions of environmental problems" (electronic conferences) and environmental news. Furthermore, by sharing information about customer needs, product concepts, distribution, etc., with other production-related departments, low-environmental-impact products can be realized more efficiently.

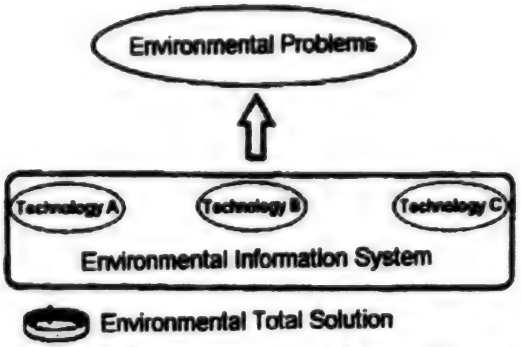


Figure 5. Environmental Total Solution Concept

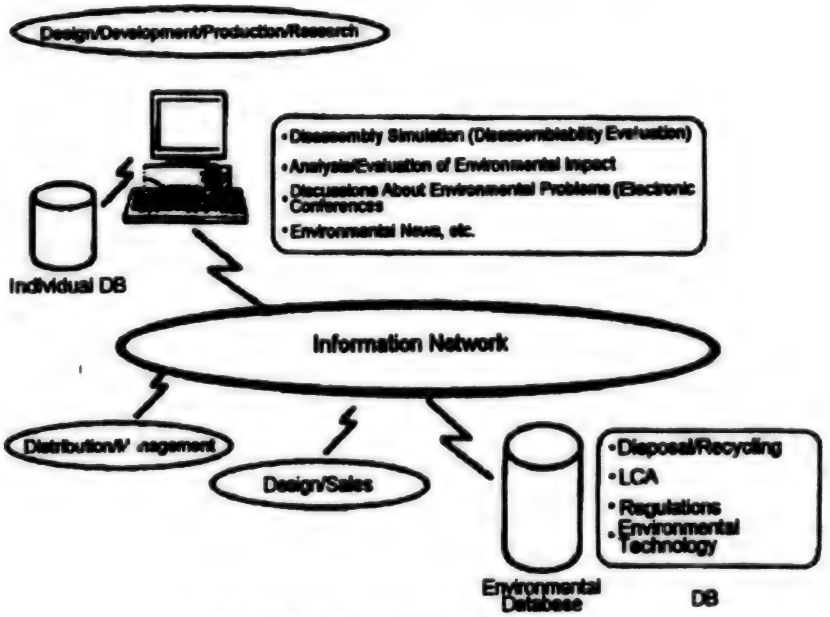


Figure 6. Eco-Communication Network

3. Eco-Product Design Software

We embodied part of the environmental total solution system in the form of software that runs on a personal computer.

3.1 Overview of the System

The eco-product design software consists of 3-D CAD and relational database software. We use the CAD design drawings to perform a virtual disassembly (assembly) and then evaluate the ease of disassembly (assembly). Furthermore, we use part names associated with design drawings and the component materials of those parts to search an environmental database (containing information about disposal and recycling problems, legal regulations, recycling technology, etc.) and then display the environmental impact (problems in disposal processing and recycling, etc.), relevant legal regulations, and so forth (Figure 7). The disposal/recycling information database, which is the core of the environmental database, lists part names, disposal (incineration, landfill) and recycling problems, relevant legal regulations, and related documents in connection with about 300 types of materials used in office-automation and consumer electronic products.

3.2 Evaluating Disassemblability

Three parameters are used to evaluate disassemblability: the time needed to undo connections (disassembly time); spatial obstructions (points of obstruction), such as a part overlapping another part, or a tool overlapping a part; and parts to be moved (points of movement). The disassembly time is calculated using the standard times for each connection that are determined in disassembly tests on the product. For example, the standard times for a desktop computer are 8 seconds for a screw, 2 seconds for a fitting, and 2 seconds for

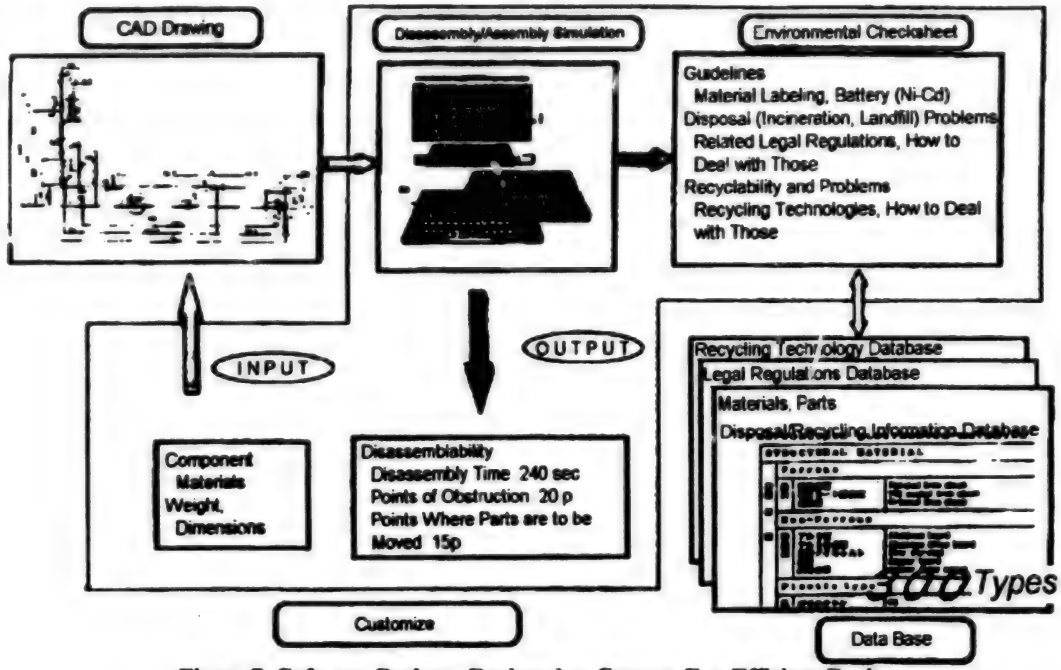


Figure 7. Software Package Designed to Support Eco-Efficient Design

a connector. The obstruction points and points to move are determined from disassembly simulations using a 3-D CAD software package.

We decide upon the disassembly procedure after information about connection methods, tools needed for disassembly, etc., and spatial coordinates of parts are entered into the parts' design drawings. The top-, side-, and front-view drawings, and a diagonal-view drawing expressed in three dimensions, as shown in Figure 8, are used in carrying out the disassembly work. First, the points of connection are disconnected according to a list of the connections of parts to be disassembled. For the connection points that are to be undone, the tools and the space needed for the task (work space) are displayed. The work space and its overlap with other parts are verified from the computer display screen, and, if there is an obstruction, an entry is made for the obstruction point (1 for an obstruction, 0 for no obstruction). If a connection point is outside of the worker's field of sight, the part will have to be moved (rotated). Rotation of a part is counted automatically as a point of movement. After all of the connections are undone, the parts are removed. Overlapping of parts is verified from the computer display screen, and any overlaps that hinder the removal work are counted as points of obstruction. After the disassembly is complete, the disassembly time, points of obstruction, and points of movement are totalized and displayed in the form of a disassemblability indicator.

3.3 Environmental Checksheet

The environmental impact expected of a product and relevant legal regulations, etc., along with the results of the disassemblability evaluation, are output in the form of an environmental checksheet. The output items are as follows.

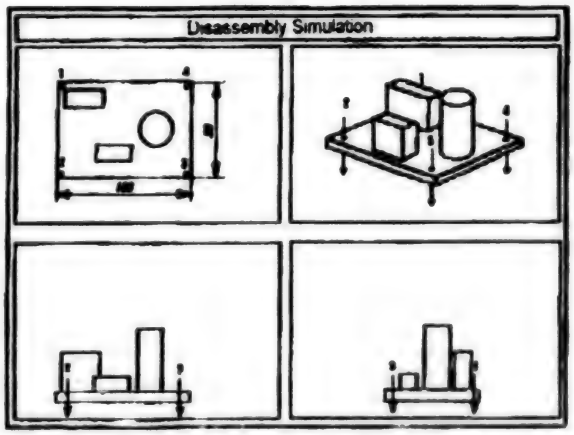


Figure 8. Disassembly Instruction

- Recycling
  - — Amounts of resin materials, iron, nonferrous metals, and nondecomposable substances used
  - — Combinations of resin materials (compatibility)
- Environmental impact
  - — Problems in disposal (incineration, landfill) and recycling
  - — Relevant legal regulations (Japan, U.S.)
- Material labeling
  - — Types and amounts of resins used
  - — ISO symbols for each resin and how those are displayed

- Battery used
  - — Battery used
  - — Labeling and other required measures
- Disassemblability (assemblability)
  - — Number of parts
  - — List of connection methods
  - — Disassemblability (disassembly time, points of obstruction, points of movement)
  - — Volume of product

4. Conclusion

In our evaluations of the environmental impact of personal computers, it became clear that there are large differences in "how gentle on the environment" a product is, even among products that have nearly the same performance. This is something that depends on how the product is used, and it gave us renewed appreciation for the importance of environmental total solution, i.e., "the technologies necessary for product development that together lessen the environmental impact of the product."

In the future we plan to proceed with the development of technology geared toward the construction of an environmental total solution system.

Kyushu University Develops Technology to Efficiently Recover Tar from Coal Using Waste Plastic

95FE0060H Tokyo NIHON KOGYO SHIMBUN in Japanese 20 Oct 94 p 1

[FBIS Translated Text] Professor Seiji Morooka and his research group at the Engineering Department of Kyushu University found that tar and BTX (benzene toluene xylene), an aromatic compound, can be efficiently recovered from coal by combining the coal with waste plastic and forcing the rapid thermal decomposition of the mixture at a high temperature. The results of experiments using polypropylene and polyethylene showed that the yields of those useful components increased 10-12%. The research was carried out as a part of the Plastic Waste Management Institute's technology development support projects.

The thermal decomposition, or thermal cracking, of coal is a technology that has long been used in the production of coke for steelmaking. Recently there has been research on recovering useful components from coal by hydrogenated rapid thermal decomposition under a high pressure, but the conversion rate and the yields of tar and other components were not improved enough for the technology to be practical.

Professor Morooka and his research group pulverized coal into 100-micron particles and waste polypropylene into 200-micron particles and mixed four parts coal particles to one part plastic particles. The researchers formed a coal and waste-plastic composite by pre-processing the particles for one hour at 200°C under nitrogen pressurization. The resulting composite material consisted of coal particles whose surfaces were coated with the waste plastic.

The researchers used an experimental device (Curie-point pyrolizer) to thermally decompose the composite material quickly and at a high temperature, then analyzed the decomposition products by means of chromatography. The results of the analyses showed that the yield of char, which is a carbon and hydrogen compound, decreased 6-7%, and that the thermal decomposition of the coal was accelerated by that alone. The tar yield increased 10-12%. Almost the same results were obtained with polypropylene and polyethylene, verifying the effectiveness of the improvement in yield.

Professor Morooka and his research group think that the yield can be raised significantly if there is homogeneous contact at the molecular level between the coal and plastic of the composite. The group's next research efforts will be aimed at obtaining smaller, molecule-size plastic particles, and processing the micro-pores of the coal with solvent to enlarge the pores.

Five Ministries To Jointly Begin R&D for Waste Recycling with Private Sector

95FE0060I Tokyo NIHON KEIZAI SHIMBUN in Japanese 12 Oct 94 p 1

[FBIS Translated Text] The Ministry of International Trade and Industry (MITI), Ministry of Health and Welfare (MHW), Ministry of Transport and two other ministries will begin a joint waste recycling effort with large companies that produce materials such as steel and chemicals. The goal is to convert waste matter into raw materials and then to produce from that materials and fuel. Concretely, the government and private sector will work together until 2000 to develop technology for waste recycling, and the government will set up a support system for waste recovery and the production and sales of products made from recycled materials. This year the ministries will decide upon concrete policies and will also investigate how to go about converting the idle facilities of material producers into production bases. The goals are to cope with the critical shortage of waste-disposal sites and to hasten the restructuring of the materials industry, which happens to have excess facilities and equipment.

The raw materials for the recycling will be noncombustible wastes from automobiles and consumer appliances, and regular household waste such as raw garbage and sludge. MITI and MHW drew up the basic plan for applying the production technology of material producers to waste recycling. The two ministries will be part of a working group that also includes the Ministry of Agriculture, Forestry, and Fisheries; the Ministry of Construction, and the Ministry of Transport. The government regards the promotion of waste recycling as an important item in its new Public Investment Plan (FY1995-2004), and this plan for cooperation with the private sector is the first concrete project of the plan.

The waste-recycling plan will involve research on the following:

1) burning noncombustible waste that is mixed with metals and plastics called "shredder dust," then recovering the metals;
2) producing cement using the ash resulting from the incineration of garbage and sewage sludge;
3) producing petroleum products made from melted waste plastic;
4) producing fertilizer from raw garbage by means of biotechnology.

The construction of regional demonstration plants is to begin in FY95.

The plan calls for the joint development of technology by the government and private sector, with the government bearing about half of the costs. The total development expenses are expected to be about ¥100 billion. In addition to revising government regulations and product standards to make it easier to sell the fertilizer and building materials that are produced from recycled waste, the five ministries will also examine the use of the recycled materials in public works projects. Furthermore, the ministries will coordinate matters so that means of transport for moving the waste to recycling sites and the construction of separate recycling centers will be expanded in the Public Investment Plan.

Although local self-governing bodies will be at the core of the production of goods from recycled materials, enterprises based on private companies will also be encouraged. The idea is to fully utilize idle blast furnaces and other facilities of chemical plants, cement plants, old mines, etc. The ministries are also examining subsidies and tax support measures when private firms become more involved in reprocessing enterprises.

The amount of waste from households in Japan is about 50 million tons per year, and about 30% of that is put into landfills. With landfill sites becoming more scarce as the amount of waste increases, "the Tokyo metropolitan area's landfill sites are expected fill up in 4.8 years," says an official of the MHW Environmental Health Bureau.

MITI Establishes Recycling System for Used Batteries

95FE0060J Tokyo NIHON KOGYO SHIMBUN in Japanese 19 Oct 94 p 3

[FBIS Translated Text] The Ministry of International Trade and Industry (MITI), in cooperation with the Japan Battery Manufacturers' Association, started a recycling system for used lead batteries from automobiles and other sources. The system adopts new supplementary routes, distinct from those used by salvage companies, that are based on battery manufacturers. MITI introduced a reverse-distribution method to recover used batteries along a direction opposite to that of the flow of products. In view of environmental concerns, more recycled lead is to be taken back by battery manufacturers. Also, for the purpose of increasing purity, the plan is to include new participants that are primary refiners, such as Toho Zinc Co. The policy of the Japan Battery Manufacturers' Association is to compile the results of surveys on the state of the enterprise every three to six months and to help with inspections and improvements.

MITI positions the used-lead-battery recycling system as one of the model recycling enterprises for this fiscal year and plans to compile a report on the system by the end of the fiscal year.

For the purpose of establishing an efficient lead recycling system, five lead-battery manufacturers—Matsushita Battery Industrial Co., Japan Storage Battery Co., Shin-Kobe Electric Machinery Co., Furukawa Battery Co., and Yuasa Battery Co.—recently decided on the framework of a program for actively dealing with the recovery, recycling, and re-use of lead storage batteries used in automobiles and motorcycles.

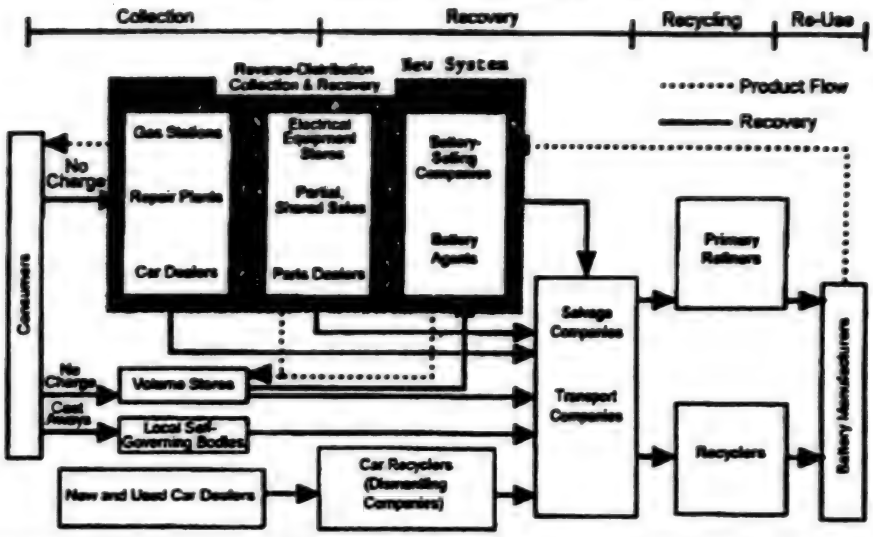
In that framework, recovery based on routes opposite to distribution routes will be introduced as a way to supplement the existing recovery routes used by salvage companies. The five companies' policy is to take batteries back from consumers for no charge and without disciminating against imported batteries or batteries made by other companies. The battery manufacturers will also purchase the recycled lead and will decide the price and other such purchase-related conditions in separate negotiations with the lead-recycling companies.

Because the need for salvaging increases in connection with the purity of the product, primary lead refining companies such as Mitsubishi Materials and Mitsui Metals also plan to participate in the area of routes for the recycled lead.

Since the decline in the price of new lead in Japan during the fall of 1991, new lead has in fact lost its economic merit, and the system for recycling used lead batteries has also been very sluggish since the fall of 1992. The percentage of lead that was recycled in 1993 fell to 63.0%, or about 30 points less than in 1989. Environmental issues, such as batteries being left on roads, and problems with consumers being charged for the recovery of batteries in the stores selling batteries have come to the surface.

For that reason in March 1994 the Minister for Health and Welfare appealed to the Minister for Trade and Industry for needed measures based on the Waste Processing and Cleanup Law. This new recycling system will be implemented as a measure to deal with that.

Conceptual Diagram of Used-Lead-Battery Recycling System



Tokyo Institute of Tech Discovers New Enzyme for Pulp Bleaching

94FE0693A Tokyo NIKKAN KOGYO SHIMBUN in Japanese 8 Apr 94 p 6

[FBIS Translated Text] Associate Professor Rikizoh Aono of the Faculty of Life Science and Engineering, Tokyo Institute of Technology, has discovered "Xylanase," which is an enzyme suited for bleaching pulp under the high temperature and alkaline conditions. This enzyme was derived from a bacterium which grew under high temperature and alkaline conditions. It can be used without adjusting temperature and pH unlike traditional enzymes. Therefore, high activity and lower cost are expected.

This discovery is expected to draw attention since an effective method is being sought to replace the chlorine method which generates harmful dioxin in pulp bleaching.

There are cellu'ose, lignin and hemicellulose which main one is xylan in the composition of woods. It is necessary to remove components other than cellulose to produce pulp. Especially, brown lignin is removed by boiling in an alkaline solution, and lignin combining with cellulose also must be removed completely.

Chlorine bleaching has been used for bleaching pulp, however, it is shifting to new methods, because chlorine bleaching generates dioxin which possesses teratogenicity and carcinogenicity. Oxygen bleaching, however, is inefficient, and it is considered to be practical when used in conjunction with xylanase. This enzyme can separate and remove brown lignin from cellulose by decomposing xylan.

Associate Professor Aono discovered a bacterium belonging to the bacillus genus from a soil which grew well in the high temperature and alkaline environment. Xylanase obtained from this bacterium exhibits its maximum activity at pH 9 and 70°C. Therefore, enzyme treatment can be done after boiling in an alkaline solution. This bacterium also has a merit of high productivity.

Traditional enzymes originated from molds functioned only under the conditions of acidity and low temperature. Therefore, it was necessary to go through a trouble of adjusting temperature and pH after boiling in an alkaline solution. There was a problem of decomposing important cellulose.

Onoda Cement Develops Coal Ash Recycle Technology

94FE0693B Tokyo NIKKAN KOGYO SHIMBUN in Japanese 13 Apr 94 p 1

[FBIS Translated Text] Onoda Cement Co., Ltd. has succeeded in the development of technology which enables utilization of a large quantity of coal ash, which is feared for its effect on the environment, as an aggregate for concrete. Coal ash has been used mainly as a mixing material for cement and a clay substitute, but there is a limit on the amount which can be used. The technology developed by Onoda allows to mix the same amount of coal ash almost as much as the amount of cement for making concrete, and the concrete shows high strength. Although problems such as assuring its durability and overcoming the usage regulations of coal ash must be cleared, the technology is likely to call attention as a technology which contributes to both the effective use of coal ash and the preservation of diminishing aggregate resources.

Coal ash, a bi-product of coal burning thermoelectric power plants, is presently utilized only as a raw material for cement, and the realty is that the majority of coal ash is being discarded to reclaiming lands. The discharge of coal ash is steadily increasing as the demand for electricity increases. Its annual discharge is estimated to reach 10 million tons by the early 21st century, and it is becoming a serious problem.

A key point of Onoda's coal ash mass recycle technology is to utilize coal ash as an aggregate for concrete instead of a traditional cement material. Coal ash has been considered for concrete, but the initial strength is low because of the low reactivity of coal ash, and there is a limit of the use amount. Onoda has solved this problem by maintaining the amount of cement in concrete at a prescribed amount, and made possible the use of a large quantity of coal ash.

Also, if this technology is used, the initial strength as well as the long-term strength increase as the use amount of coal ash increases.

It has been said that the strength of 1.5 times of regular concrete was obtained between three days and six months after laying concrete when sand (aggregate) was replaced at a certain ratio on the volume basis with coal ash equal to the amount of cement which unit amount was 300kg per 1 cu. meter.

Tohoku U. Steps Closer to PET Waste Recycle

94FE0693C Tokyo NIKKAN KOGYO SHIMBUN in Japanese 13 Apr 94 p 15

[FBIS Translated Text] Professor Akitsugu Okuwaki and Assistant Professor Toshiaki Yoshioka, et al. of the Department of Molecular Chemical Engineering, Faculty of Engineering, Tohoku University have succeeded in recycling used PET (polyethylene terephthalate) bottles, which are used for beverage bottles, etc. by splitting them into high value added raw chemicals and recovering the chemicals. This is the first development of technology which recovers two high value added raw chemicals such as terephthalic acid, which is a raw material for polyester resin, and oxalic acid, which are used as bleach, polish and rust remover, etc. by treating powdered PET bottles using the nitric acid hydrolysis/oxidation method. This has opened the door for the chemical recycle of PET bottles.

The domestic use of PET bottles, which are used for beverage bottles, reached 137,000 tons in 1992. Because of the limitations of burying and incineration the establishment of their recycling system has been sought for.

Now, what Professor Okuwaki, et al. has developed is the chemical recycling of PET bottles. Used PET bottles are pulverized to the size of about 0.1mm; then, resolved by dissolving in nitric acid of concentration 50 to 60 percent, and reactions were continued for about 15 to 16 hours at 100°C. The powder is decomposed to terephthalic acid and ethylene glycol. Terephthalic acid is recovered by filtering at high temperature since it does not dissolve in nitric acid and float.

Then, dissolved ethylene glycol is oxidized by nitric acid and crystallized as oxalic acid when the temperature is lowered to room temperature. Oxalic acid is then recovered. They have succeeded in the recovery of terephthalic acid and oxalic acid, 100% and 35%, respectively. It is said that the nitric acid solution can be reused.

Both chemicals are being used as high value added raw chemical materials, for example, terephthalic acid as a raw material for polyester resin, etc., and oxalic acid for manufacturing of thick malt syrup and glucose, and as bleach and rust remover, etc.

Especially, there is a large merit for recovering and utilizing oxalic acid from waste PET bottles, because oxalic acid is presently manufactured from ethylene glycol which is produced from petroleum.

Nihon Ekosu Develops Low Pollution Fuel for Trucks

94FE0693D Tokyo NIKKEI SANGYO SHIMBUN in Japanese 19 Apr 94 p 5

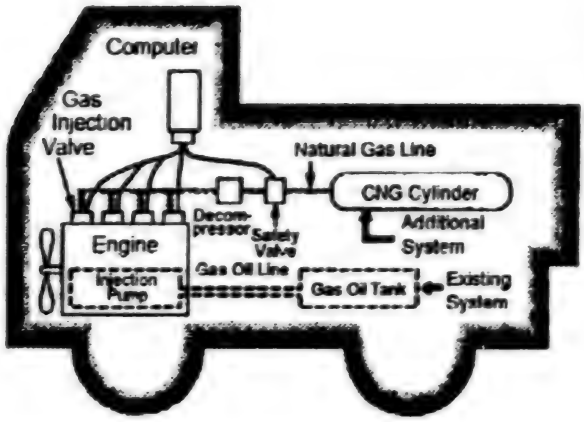
[FBIS Translated Text] Nihon Ekosu, a venture company who is involved in engine development, has developed a low pollution truck which can utilize both compressed natural gas (CNG) and gas oil. It uses a diesel engine with improved equipment called "CNG-Diesel Dual Fuel (DDF) Equipment," and it reduces the discharge of NO_x (nitrogenous oxides) by more than 20 percent compared with conventional trucks. Its special feature is that a conventional truck can be modified by mounting the equipment with the cost of less than 5000 dollars. Nihon Ekosu is aiming to spread it through marketing its technology to domestic major truck makers.

The DDF equipment sends CNG and air together into a cylinder at the intake stroke. Ignition takes place by injecting gas oil at the compression stroke like an ordinary diesel engine. Ekosu has been conducting tests by mounting the equipment on an Isuzu Motors small truck, "Elf", and will soon apply Ministry of Transport for the minister's approval for road testing.

Although gas oil is used to start ignition, the main fuel is CNG. Therefore, the discharge of NO_x is reduced by 20 to 30 percent compared with a diesel car. The discharges of black smoke and SO_x (sulfur oxides), which are regarded as the causes of diesel pollution along with NO_x, become almost zero.

Some truck makers are developing low pollution vehicles which utilize CNG as a sole fuel. The CNG vehicles, however, require spark plugs, and it is necessary to do large modifications of ordinal diesel trucks. Also, the distance covered by one fuel supply is 40 percent less than that of diesel trucks because of the limit of fuel tank. It is forecasted that the price of the equipment itself is below 5000 dollars once the mass production starts.

Ekosu is a venture company which is financed mainly by IPD, that is a maker of environment instruments, and by Ohbayashi and Sanyo Electric, etc.



Ishinomaki Senshu U. Develops Small-Scale Waste Water Treatment System

94FE0693E Tokyo NIKKAN KOGYO SHIMBUN in Japanese 19 Apr 94 p 4

[FBIS Translated Text] Assistant Professor Mitsuru Takasaki et al. of the Department of Production Engineering, Faculty of Science and Engineering, Ishinomaki Senshu University have developed a water treatment system for the treatment of small-scale waste water. It has two new features such as movable layers of microbial catalysts for decomposing organic matters and a system to remove nitrogen. Therefore, the stability and longevity of treatment effects such as biochemical oxygen demand (BOD) and the elimination of germs, for example, colon bacilli, have been improved compared with the conventional fixed floor type contact oxidation treatment system. Miyagi Prefecture's Ishinomaki City, where the faculty is located, is hoping to introduce the system to isolated peninsular regions, which are outside the city's sewer treatment planning districts.

The developed treatment system consists of one anaerobic tank and three aerobic tanks which air is removed by aeration. Those four tanks are connected in series, and waste water is circulated among them. All four tanks are 1.25 cubic meter each. The catalysts are microbes attaching naturally to vinylidene chloride strings (about 80cm) which are hanging from steel frames. The steel frames are supported by beams extending from rails which are laid both sides of the tanks. It is a system that the catalytic layers reciprocate in each reaction tanks as the beams move on the rails by the power of air cylinder.

Nitrite bacteria, BOD oxidation bacteria, protein-digesting bacteria and nitrification bacteria are piled up 3 to 4cm on vinylidene chloride. The movement of catalysts in treatment tanks prevents the catalysts from plugging, and improves treatment efficacy through even reactions on the entire catalysts.

The catalyst in an anaerobic tank is nitrite bacteria and converts ammonia to nitrogen gas in combination with nitrification bacteria residing in aerobic tanks. Therefore, there is no need to treat the water with chlorine, and the water can be discharged directly to rivers.

A pilot plant with the length of 9m, the depth of 1.25m and the width of 0.5m was constructed in the city's sewer treatment plant. The results of three-month continuous comparison test with the conventional fixed floor catalyst oxidation treatment system show that the conventional system had 20 to 30 percent lower BOD removal rate, which is the cause of water pollution, on the other hand, the new system maintained about 95 percent, and exhibited 5 to 6 times of the nitrification speed, which is an indicator of nitrogen removal.

Sony Develops New Green LED

94FE0922A Tokyo NIKKAN KOGYO SHIMBUN in Japanese 14 Jul 94 p 7

[Interview with Yoshifumi Mori, Materials Technology Research Department, Sony Central Research Institute]

[FBIS Translated Text] High Tech Interview: True Green Light Realized; More Colors than Television, Utilizing Laser Technology

True Green Color Was Nonexistent

[NIKKAN KOGYO SHIMBUN] Let's start with the principles of the LED (light emitting diode).

[Mori] When a p-type semiconductor (plus) and n-type semiconductor (minus) are connected and a forward current is run through them, the holes (holes for passage of electrons) that exist in the p-type semiconductor and the electrons that exist in the n-type semiconductor unite near the p-n junction and emit light. This is the basic principle of light emission. The color of emitted light differs with the type of semiconductor, and LEDs for red, orange, yellow and yellow-green already have been realized.

[NIKKAN KOGYO SHIMBUN] There was no green LED?

[Mori] Color variation of light comes from variation in wavelength. The range of wavelengths in visible light rays, which can be seen by the human eye, is 0.78-0.38 microns (1 micron is one-thousandth millimeter), with red having the longest wavelength and blue having the shortest. In addition to LED colors that have been realized, the development of blue and blue-green LEDs have been reported, but until now, there was no true green. The wavelength of the light emitted by this LED is 0.512 microns, which falls between yellow-green and blue-green.

[NIKKAN KOGYO SHIMBUN] What about brightness?

[Mori] It is about 4 candelas. It does not compare with some red LEDs that are 10 candelas, but it is much brighter than yellow-green LEDs with somewhat longer wavelength and blue-green LEDs with somewhat shorter wavelength. The brightness of an LED, which is a point light source, is measured without consideration given to area of light source, so it seems like a small value, but if many LEDs are laid out and brightness compared, it should be possible to make a product that is 100 times brighter than existing displays, even with the brightness of this LED.

New Material for Cladding Layer

[NIKKAN KOGYO SHIMBUN] What is the key to improving luminosity?

[Mori] With the latest LEDs, material called "cladding" which covers the top and bottom of the light emitting layer, has been used to improve light emitting efficiency, but there was no optimum material for cladding in the case of green. Sony has been working on developing a blue semiconductor laser, and adopting a new material that was discovered in the process of that development has led to improved brightness.

[NIKKAN KOGYO SHIMBUN] Why is green necessary?

[Mori] Red, green and blue are the three primary colors of light, and a variety of colors can be manifested by mixing them. It would be possible to make color displays that use LEDs if LEDs were available in the three colors, but until now, there was no true green LED, so the number of colors that could be displayed was less than with televisions. By using this LED, however, more colors can be manifested in displays than in televisions.

Practical Use in 2-3 Years

[NIKKAN KOGYO SHIMBUN] What are the issues to be addressed in the future?

[Mori] A life of 5,000 to 10,000 hours is being sought for LEDs. Measurement of LED life has not even been carried out, so nothing definite can be said, but this problem has to be surmounted first of all. Another is to raise luminosity further. This LED spreads light in all directions. Commercial products are equipped with reflectors, etc., to emit light in a single direction, and it is believed that brightness can be raised to about 15 candelas by adopting this sort of structure. The plan is to achieve practical use of this LED in 2-3 years.

STA Projects Japanese Research for ITER in Next Fiscal Year

94FE0922B Tokyo NIKKAN KOGYO SHIMBUN in Japanese 19 Aug 94 p 5

[FBIS Translated Text] STA, JAERI Start Moves To Host ITER to Japan

Will Study Organization Next Month

The Science and Technology Agency (STA) and the Japan Atomic Energy Research Institute (JAERI; Shozo Shimomura, director) has set a policy of attracting the International Thermonuclear Fusion Experimental Reactor (ITER) to Japan. From next month, they will study the ideal form of international joint research and a concrete organization for ITER construction, and also will begin studies concerning Japan's evaluation as a host, and evaluation and selection of a construction site.

Survey Funding To be Included in Next Year's Budget

ITER is a research project that demonstrates fusion, the ideal source of energy. Its goal is 1,000 seconds of combustion with a heat output of 1.5 gigawatts. Construction cost is around ¥1 trillion. To accumulate knowhow for developing an operational fusion reactor, and gain the advantage in development competition, which extends from prototype reactor to demonstration reactor to operational reactor, the United States, France, Germany, Sweden, et al., have become informal "candidates" for hosting the ITER.

STA and JAERI decided on the policy of attracting ITER to Japan and began studies because circumstances overseas suddenly began to change. The engineering design activity of the ITER project has entered its second phase, and the timetable calls for the participating countries to decide on a construction site in 1995 at the earliest or by 1997 at the latest, and then begin the detailed design.

Moreover, another reason for accelerating the study is that a special working group to decide on a framework for construction consultations is expected to be formed at the December meeting of the ITER board of directors, and a response and active suggestions will be sought from Japan.

In the board of directors meeting and the special working group that will be formed, as well as in the construction consultations that will start around June 1995, STA and JAERI plan to actively express Japan's views and put Japan in an advantageous position in the competition to host the project.

Specific items to be studied include the ideal for joint international construction of the ITER, the organization for formulating bids for construction and operation, and the preparation of international laws to promote ITER as a joint international project. STA will study the preparation of international laws, and STA and JAERI will work on drafting Japan's proposal concerning such matters as operational organization.

As for selection of a construction site in Japan, which is essential to host the project, JAERI has appropriated ¥ 55 million from the FY95 budget for "preliminary survey for an environmental assessment for ITER siting." The aim is to collect data that will stand up to international comparison and that is needed for site selection, including conditions that must be met to host the project, such as amount and topography of land, water and electric power, environmental conditions to support researchers and their families, and a geological boring survey. Site selection will be carried out by a selection committee to be established by the national government.

Before the negotiations, STA plans to coordinate its views with the Foreign Ministry and the Finance Ministry in order to unify the nation's views and clearly show fiscal backing for hosting the ITER project.

Joint Research Group for Micromachine for Medical Use To Be Established

95P60032 Tokyo NIKKEI SANGYO SHIMBUN in Japanese 9 Nov 94 p 15

[FBIS Translated Text] Mitsubishi Research Institute is planning to establish a joint research group with industry, government, and acamedia to conduct research on micromachine technologies for medical applications. The Ministry of Health and Welfare (MHW), the private sector, and clinicians will jointly study the subject and Mitsubishi Research Institute will conduct market research and provide the results to the new research group. Although the Ministry of International Trade and Industry (MITI) has been the principal group conducting research on micromachines, the new group will be formed in response to a drastically increasing need for the development of equipment for treatment of medical conditions. Mitsubishi Research Institute plans to conduct research closely related to the needs

A special research committee established by approximately twenty clinicians and chaired by Professor Masayoshi Fuji of the Research Center for Advanced Science and Technology of the University of Tokyo, will be the center of the new research group. MHW's Medical Equipment Development Division of the Pharmaceutical Affairs Bureau will participate as an observer. The group is asking companies, including medical equipment manufacturers and pharmaceutical companies, to participate. The group predicts that some twenty companies will join the group.

The group will focus on ten research areas such as the digestive system, the circulatory system, and the cranial nervous system. In concrete terms, companies will explain the status of technological development and clinicians and MHW officials will discuss commercialization of technologies in the group meeting. Mitsubishi Research Institute will conduct market research in each area and will provide the results to the group.

The group's first meeting is scheduled for 25 November and monthly meetings will be held until April 1995.

Changes in Electronics Manufacturers R&D Themes as Seen from Patent Gazettes and Utility Models

94FE0722A Tokyo NIKKEI ELECTRONICS in Japanese 23 May 94 pp 101-106

Article by Komei Hibi, Attorney

[FBIS Translated Text]

Lecture on Intellectual Property Rights

It can be inferred from patent gazettes and utility models that changes are occurring in the R&D fields that electronic manufacturers are pursuing, and an analysis has been made to indicate the degree of technological restructuring. Comparisons of various companies have been made by taking into consideration the changes in the number of patent applications submitted in differing technological fields. As a result, it can be inferred that Seiko- Epson and Toshiba are actively engaged in technology restructuring. For example, Seiko-Epson is extending the percentage of patents relating to semiconductors and printers, while Toshiba is extending the percentage related to computers and image technology. It was found that Fujitsu and Victor Co. of Japan are engaged in little technological restructuring. (The editors)

Restructuring is being actively pursued by companies in response to poor economic times. However, the reports of corporate restructuring that the mass media present are nearly all dependent on the statements issued by those corporations. Many well- publicized events are indeed taking place such as the reduction of personnel, the conversion of facilities, revision of new construction investments, and the closing of plants, etc. This kind of restructuring makes up the so-called "facade of restructuring", and involves areas of business that third parties can easily understand.

Separate from this kind of economic and labor restructuring, R&D is undergoing a quiet but deep change of direction (a restructuring) that is happening below the surface of the corporate world.

The hypothesis that "the life span of a corporation is 30 years" has been put forth in the magazine "Nikkei Business." The analysis says that, no matter what the corporation, if it does not keep in step with the economic changes of society, the life span of a corporation which continues to market the same product in the same field will be exhausted in 30 years. A corporation cannot survive by clinging to the same technological field. In order to avoid this, the trends of society must be analyzed and new markets found. The natural conclusion is that a technological field which has been developed thus far will eventually evolve into a technological field that is completely different. Depending on the corporation, over the passage of years the quality of the business changes without that company being aware of it, and many times the company may find itself eventually doing business in an area completely different from its original business.

For example, Meiji Seika, whose products were nearly all food stuffs, is currently manufacturing pharmaceutical and chemical products. There are numerous examples of this, and in order for a corporation to survive, its mission must be to keep pace with the progress occurring within the world and within society, and to constantly develop technology in new fields.

Seeking Out Corporate Trends From the Patent Gazette

There are very few ways in which the direction corporations are steering their R&D is publicly disclosed. This is because the progress is kept secret and held below the surface. About all the common person knows about the progress made into new technologies comes from public information released about completed technology, or from advertisements for marketing new products. Opportunities to know about technological restructuring in corporations comes only after a considerable amount of time has elapsed since the corporation decided to embark into the new field.

However, when a corporation engages in R&D on a new technology, because they must always submit patent (utility model) applications in order to protect property rights for later on, this patent information can be used as a technique to find out what the corporation is doing. It is rare that a new technology is confined internally without a patent

application (Exceptions are know-how that cannot protected as an invention, and knowledge that is kept with an extreme degree of secrecy such as national defense technology). Unless patent applications are submitted for the new technologies that have been developed, other companies developing similar technology may apply for the patents, and it is not possible to prevent them from doing so.

After one and one-half years have elapsed since the day of application, the technology for which a patent application has been submitted is publicly disclosed by being cited in the "Patent Gazette" which is published by the Japan Patent Office (together with the "Utility Model Gazette," this is public information).

Anyone may acquire this patent information, and from it such information as the contents of the technology, the specifications, and the inventors may be known. This is convenient in that the technical fields which each company is researching can be determined, and the intentions of competing companies can be known. The research contents of other companies can be discovered at an early period using patent information, and for companies that are developing a new technology, it provides an opportunity to know which fields should be entered at this point, and what the trends of competing companies may be.

If the patent information published from a specific company is promptly acquired and its contents analyzed, it should be possible to objectively analyze what fields that company is researching.

In this article we are analyzing the deep technological restructuring occurring in several companies, as well as the "degree of technological restructuring" that is intended by each.

The Content of Patent Applications Are Classified by IPC Number

Listed on the upper left corner of the first page of all patent applications is a seven or eight digit number mixed with English letters. This is called the International Patent Classification (IPC), and it indicates the technological fields to which the idea being patented belongs.

The amount of patent information published in the past is enormous. Currently, the amount of patent information being published world-wide has risen to several million patents annually. Thus, it requires a great effort to narrow this huge volume down to just the patent information that belongs to a specific technology.

To reduce this effort, IPC classification numbers indicating the contents of each patent are added as a means to easily sort out the targeted patent material. By conducting a search using the IPC numbers, it is possible to gather just the patents relating to a specific technology without reading the entire contents cited in the Gazette. The contents of the classification and the display method, etc. for each IPC number has been established in a common system used around the world, and thus searches can also be conducted in the patent materials of foreign countries.

When applying to the patent office, the classification examiner in the Classification Examination Office studies the contents of each application, and applies the appropriate classification number in relation to the contents of the application. According to the official patent Gazette, multiple IPC numbers maybe applied in relation to a single application. This is because when the contents of an application may branch out widely, and the IPC number belonging to each technology included is then attached.

Among these IPC numbers, the IPC number listed in the highest rank is called the head classification. This displays the classification of technology that is most closely related to this application.

The IPC code is divided into fields of technology. The technology corresponding to the code is reviewed using the "International Patent Classification Table". This code includes from the left:

(1) section (one English letter);

(2) class (two numerals);

(3) subclass (one English letter);

(4) main group (1-3 numerals);

(5) subgroup (1-3 numerals) (Table 1).

Analysis of Six Years up to 1992

If all the patents of a specific corporation are gathered, and the number of IPC classifications which are attached to those patents are tallied, then the kinds of technologies that that corporation is researching can be known. If the total patents published are studied for the changes in the number of patents in each IPC classification over the period of a year (one year is from January 1 to December 31), then it should be possible to objectively judge how the trends are changing for the technologies being researched by the company.

In this study we looked for trends by analyzing annual changes in the technologies that various companies are researching utilizing the patent gazettes published by the Japan Patent Office over the six year period from 1987 to 1992. In this analysis, the three- year period from 1987 to 1989 was taken to be the first period; the three years from 1990 to 1992 was taken to be the second period; and the distribution of IPCs from publicly disclosed patent information was analyzed for both.

First, the total number of patents disclosed for a specific corporation during both the first period and the second period were tallied. Then, the IPCs attached to all of the patent publications were tallied for each of the two periods, and the IPC trends were analyzed. Multiple IPCs are attached to disclosed patent information, but we treated the patent publications as if they had just a single IPC by using only the head classification in these tallies. This was done because it is more convenient to make the tally by specifying the head IPC to be the technological field.

In this way, the patent publications disclosed over a six year period were taken to be the standard, and what kind of research is being conducted in which technological fields can be analyzed from the number of patent disclosures that each company has accumulated (refer to "Method of Calculating the Degree of Restructuring", p. 106).

Epson and Toshiba Exhibit a High Degree of Restructuring

Table 2 (not reproduced) is a ranking lining up the companies in the order of the highest evaluation points. Only companies relating to electronics devices are indicted in this table. Seiko-Epson and Toshiba can be cited as corporations exhibiting a high degree of restructuring. In contrast to this Seiko Electronics Industries and Japan Victor are companies exhibiting a low degree of restructuring.

In order to make the degree of technological restructuring for each company visually easier to understand, the information is displayed in radar charts.

Twelve radial lines are drawn from the central point. The IPC which occupies the largest percentage of IPCs of the patent disclosures of the second period (equivalent to F in the "Method of Calculating the Degree of Restructuring" on p. 106) is allotted to the line equivalent to the twelve o'clock position, and the other IPC classifications are attached clockwise in descending order of the percentage of IPCs. A spiral shaped connecting line is drawn around the twelve radial straight lines. This then becomes a diagram of the percentage of patent disclosures each IPC field occupies among the total number of patent disclosures during the second period.

The first period percentages of patent disclosures corresponding to each IPC classification are then added to the twelve radial straight lines following the same order. The area under the connecting lines that is filled in in blue is related to the percentage of patent disclosures each IPC classification has in relation to the total number of patent disclosures for the first period. By doing this, what direction the R&D of a company is taking in any given technological field can be known by looking at the percentages of patent disclosures that a IPC classification has in the first and second periods.

Here, we will use the radar charts to explain how Seiko-Epson and Toshiba are examples of companies with high degrees of technological restructuring; Fujitsu is a company with a middle degree; and Victor Co. of Japan is a company with a low degree.

Technological fields with a high percentage of patent disclosures for Seiko-Epson are covered in the following IPC classifications: H01L (semiconductors and integrated circuits, etc.), B41J (dot printers, etc.), G06F (computers), G03G (related to electronic copying such as copiers and laser printers), etc. Figure 1, Table 3 (not reproduced). The areas where the research policies have changed greatly can be understood by looking at the places where the connecting lines become distorted.

The percentage of patent disclosures has decreased in such areas as G02F (optical beam modems, frequency converters and liquid crystal panels), G11B (hard disk devices, optomagnetic disk devices, etc.), and H04N (image communications, facsimile, and television). We would like to pay close attention to the strong increase in the number of patent disclosures in H01L and B41J, as well as the decrease by half in G11B. It can be inferred that Seiko-Epson is probably cutting back research in the technologies relating to G11B, and are instead shifting their focus in the direction of the technologies of H01L and B41J.

Toshiba has a high percentage of patent disclosures in G06F, H04N, A61B (medical diagnostic equipment and surgery equipment), and B66B (elevators and lifts), but the percentage of the number of patent disclosures are decreasing in H01L, G11B, G03G, and H01J (electron tubes, discharge lamps), etc. (Figure 2 not reproduced). In particular, the percentage in G11B and H01J have decreased sharply, and there has been a large increase in the percentage of the number of patent disclosures in G06F and B66B. However, no large changes in other IPC classifications can be seen.

Figure 3 not reproducedshows Fujitsu. The connecting lines of the first and second periods neatly fit over each other, and there are no glaring changes like Seiko-Epson and Toshiba had. However, the percentage of the number of patent disclosures in H01L, and H04L (digital communication devices and digital transmitters and receivers) is increasing, and the percentage in G06F is decreasing.

Because Fujitsu is a corporation that has specific development themes such as computers and telephone switches, it probably has an essential quality as a corporation that cannot easily transform itself into new technological fields. In a corporation that continues to have a large volume of applications at nearly 10,000 per year, even if there is this tiny percentage of change it can probably be inferred that within the company there are changes in research themes because the number of disclosures in one IPC classification has varied from several dozen to several hundred.

Then, Victor Co. of Japan can be determined to have a low degree of technological restructuring as indicated in Figure 4 (not reproduced). The percentage of patent disclosures in G02F and H01F (transformers and chokes, etc.) are increasing. Looking at the whole, the number of patent disclosures in the second period have decreased from the first period. In particular, in the technological fields that could be called the core area of Victor Co. of Japan, there is a reduction in the percentage of G11B and H04N, which indicate a high percentage of their disclosed patents. The number of patent disclosures in G02F and H01F, which have increasing percentages, are few, and it can be seen that currently they are technological fields with a low importance. Although they are making an effort to shift into new fields, there has probably not been a rise in research successes.

In addition, when comparing Victor Co. of Japan in Figure 4 and Fujitsu in Figure 3, the fluctuations of Victor Co. of Japan appear to be larger. However, in comparing the number of patent disclosures for each company, those of Fujitsu are clearly more numerous. Because a large correction value was used to calculate the evaluation points, Fujitsu is positioned at a higher rank. If a corporation has a large number of patent applications, it may be thought they are putting a great effort into that research and development.

Method of Calculating the "Degree of Restructuring"

The number of annual patent disclosures for a given corporation is not always the same, and there are corporations that have large fluctuations in the total number of patent disclosures every year. Moreover, there are also differences

between corporations in the number of patent disclosures they have made, and it is difficult to simply compare them. There is a technique available for incorporating the total number of patent disclosures and the number of patent disclosures of each IPC classification for the first period (1987-1989) and the second period (1990-1992) into an independent formula. By doing this, we are able to calculate the degree of restructuring for a specific corporation using an absolute index irrespective of the size of the corporation or the quantity of patent disclosures. The degree of restructuring for each company can be evaluated by utilizing the absolute index calculated by this formula. This procedure is indicated in the following points (1)-(6).

(1) Calculate the percentage of IPCs in each period. Calculate 100 percent of patent disclosures for each IPC classification in relation to the total number of patent disclosures for the first period and the second period.

C = (the number of each IPC classification for the first period A) divided by (the total number of patent disclosures of the first period B) x 100.

F = (the number of each IPC classification for the second period D) divided by (the total number of patent disclosures of the second period E) x 100.

These express the percentages that the technological fields targeted for research have in each period.

(2) Take the absolute value of the difference between C and F.

$G = |C - F|$

G expresses the degree to which the proportion of patent disclosures in each respective IPC classification is increasing or decreasing from the first period to the second period. This is called the "degree of restructuring" for each IPC classification. An absolute value is taken with the idea that, whether it is increasing or decreasing, restructuring is going on.

(3) Ranking the IPC classifications according to the degree of restructuring G. The degree of restructuring G of each IPC that was calculated in this way is lined up in order from the greatest absolute value. Only the top twenty IPC classifications are targeted for calculating the degree of restructuring. There are also situations in which the technological range in which research is being done by the corporation is narrow, and there are not twenty fields with head IPCs. In this situation, all the IPC classifications are targeted for calculation.

(4) The degrees of restructuring G are totaled. A total value is found for the degree of restructuring of each IPC up to the top twenty ranks, and this grand total is taken to be the total value H of the degree of restructuring. From this value, the degree of restructuring can be identified for each corporation.

(5) Revision using a correction value. The total value of the degree of restructuring based on the IPCs of the top twenty fields is calculated for each company, but these figures cannot be compared as is. The reason is that there are large discrepancies in the number of patent disclosures made by the various corporations. The number of annual patent disclosures of a company with 100 patents cannot simply be compared to a company with 10,000 patents.

Specifically, if a corporation which submits 100 patents annually applies for ten patents in a new technology, the restructuring change is 10%. With a corporation that applies for 10,000 patents annually, then, if arguing for the same percentage, it would have to apply for 1,000 patents in a new field of technology.

(6) Calculate the degree of restructuring evaluation points. For this reason, the degree of restructuring calculated value for each corporation is multiplied by the correction value, and this is a means in order to be able to correct and determine the corporate effort being made based on the number of patent applications. This correction value is taken to be the cubic root of the total calculated value of patent disclosures of the IPC classifications of the top twenty ranks in the first period and the second period. Evaluation points, then, are the product of the value of the degree of restructuring times the correction value.

TRU/Pu Mixed Fuel for Fast Breeder Reactor

Attempt to Prevent Nuclear Weapon Conversion

95P60064A Tokyo NIHON KEIZAI SHIMBUN in Japanese 28 Nov 94 p 17

[FBIS Translated Text] The Atomic Energy Commission of Japan (AECJ, Chairman: Science and Technology Agency Director-General Tanaka) has decided to use transuranium (TRU) elements, heavier than uranium and part of spent nuclear fuel, as fuel for fast breeder reactors (FBR) and will start formulating specific measures to that end. AECJ intends to appeal to world opinion by including concern for non-proliferation and peaceful usage in their nuclear power generation program by preventing the conversion of plutonium (Pu) and TRU mixed fuel to nuclear weapons use. Use of Pu/TRU mixed fuel also will make permanent disposal efforts of waste easier because TRU is removed from high level waste. It used to be the most troublesome issue in the use of nuclear power. AECJ will form a special sub-committee before the end of December. The sub-committee will draw up a blueprint for a new nuclear fuel cycle based on the Long Term Plan for the Development and the Use of Nuclear Power which stresses "no possession of excess plutonium."

Spent nuclear fuel generated from nuclear power plants contains TRU elements such as neptunium, americium, and curium which also are useful as nuclear fuel. Traditionally, TRU, after separated into uranium and plutonium at the reprocessing plant, have been combined with other substances to be disposed of as a high level waste. The new proposal by AECJ calls for revision of the TRU handling process. TRU is highly radioactive and has a half-life of over 10,000 years. However, if burned in the FBR it can be converted to short half-life radioactive elements.

AECJ will form a "Special Sub-Committee for the Nuclear Fuel Recycle Program" in December to formulate a new cycle plan. Three special sub-committees for the "Fast Breeder Reactor Development Program" which had functioned under the AECJ up to now will be dissolved. Instead, 2 sub-committees on "Recycling Technology" and "Fast Breeder Reactor Research and Development" will be set up under the AECJ. Professor Mamoru Akiyama of the Faculty of Engineering, Tokyo University, will be appointed Chairman of the sub-committees.

The Sub-Committees will conduct a feasibility study to develop a technology for TRU/Pu mixed nuclear fuel which will be useable for a demonstration FBR scheduled to start construction in early 2000. It is difficult to extract pure plutonium from the mixed fuel which can be used to make atomic bombs. Therefore, Japan can demonstrate to the world that there will be no chance of converting mixed fuel into nuclear weapons and instead focus on nuclear energy for peaceful purposes.

Also by "eliminating" long half-life TRU from high level waste, the permanent disposal efforts for high level waste will be simplified, resolving the most serious obstacle to the use of nuclear energy.

AECJ will spend one-two years to study the development plan for a series of technologies including production of mixed fuel, design of demonstration FBR, and reprocessing of spent nuclear fuel generated by FBR in order to promote a comprehensive R&D system.

Coping with Overseas Criticism

Japan's nuclear policy which called for development of FBR using plutonium in pursuit of energy self sufficiency has reached its initial goal now that the prototype "Monju" reactor reached criticality in April 1994.

However, the environment surrounding FBR is not necessarily friendly. Many advanced overseas countries such as the United States have abandoned its development. France also limited its operational capacity to only TRU burn-up research purposes by eliminating Pu's breeding function when they reopened the demonstration "Superphoenix" in August 1994. Japan ended up the only country using plutonium.

FBR can create more plutonium, used to make atomic bombs, than it consumes as a fuel. Therefore, questions arise about Japan's eventual development of nuclear weapons. The TRU/Pu mixed fuel approach should provide one means of denying that possibility. It is difficult to extract pure plutonium from mixed fuel. Therefore, it should help alleviate international nuclear non-proliferation concerns.

However, a number of difficult issues remain. In order to burn mixed fuel, FBR's core requires a different design. It is also important to examine how hard it is to extract plutonium from mixed fuel. How are production facilities for the fuel obtained? How can the problem of a lack of funds be solved? It is also necessary to complete the project once the TRU recycle plan is finalized.

FBR certainly is inferior to existing light water reactors (LWR) in economic terms. Therefore, it is necessary to develop easily understood public explanations of the necessity of developing FBR. The Special Sub-Committee must prepare answers to the above questions as they formulate their new program.

Many Private Japanese Companies Provide Support for Spring-8 Synchrotron

94FE0920A Tokyo TOKYO SHIMBUN in Japanese 31 Aug 94 p 4

[FBIS Translated Text] 1998 Completion Targeted for Synchrotron Radiation Facility: Will the "Nano Flower Project" Bloom?

Work is proceeding on the "nano flower project," a plan to build the world's first privately-owned synchrotron radiation facility in Ichihara City, Chiba Prefecture. The facility will produce extremely bright light that can be used in a broad range of fields, including the development of new materials and pharmaceuticals. The Japan Management Association, Inc., called together private companies to form a research group in July with the goal of completing the facility in 1998.

A synchrotron is a circular accelerator used in elementary particle research, etc., in which light is emitted by accelerating electrons to nearly the speed of light then altering their direction with magnetic fields. This is radiation, in which a broad spectrum of light, from infrared to x-ray, is emitted. Light of a desired wavelength can be extracted by spectral diffraction.

Radiated light has higher luminance (brightness) than normal light, and it is highly directional. Although laser light also is highly directional and covers a broad spectrum, radiated light is better in that it covers the x-ray range and has higher luminance.

Under the Japan Management Association's project, the synchrotron radiation facility will be built on a hill in the northeast section of Ichihara City, Chiba Prefecture, with a total operating cost of about ¥ 18 billion. A science park and residential zone, which will incorporate the facility, will be built on a site of about 171 hectares. The plan calls for construction to begin in 1996, trial operation to start by the end of 1997, and commercial operation to commence from 1998.

The type of accelerator is to be decided within the year. At present, a synchrotron that can accelerate electrons to 2.5 billion electron volts (i.e., a medium-scale radiation facility) is being considered.

The shortest wavelength of radiated light to be extracted will be 0.5 angstroms (1 angstrom is .00000001 centimeter), which extends into the range of hard-radiation, short-wave x-rays. Luminance will be a hundred to ten thousand times greater than normal light. It is expected that this will enable rapid three-dimensional crystalline structure analysis and microprocessing of semiconductors.

The project name associates the name of Chiba Prefecture's flower, the "nanohana" (rapeseed blossom), with "nano-," which means one billionth, and reflects the desire to bring the project into full flower in the nanometer realm where synchronous light is applied and used.

There are 28 participants in the research group that was formed last month, including Tokyo Electric Power Company, Tokyo Gas Company, Toyota Motor Corporation, Kao Corporation and Olympus Optical Company.

Enlistment of participants in a forum to study methods of use has begun, and about 30 companies are expected to have joined the forum by the deadline (last part of October). The Japan Management Association wants to increase this to about 100 companies in 2 or 3 years.

Possible uses that have been raised are electronic engineering applications such as ultra-super LSI (large-scale integrated circuit) lithography, three-dimensional structural analysis of biopolymeric protein and development of efficient medicine and drugs, and research on effective catalysts for oil refining.

There are almost 20 synchrotron radiation facilities in Japan. Of these, the "SPring-8" (super photon ring 8 giga electron volts), which the Science and Technology Agency is constructing in Hyogo Prefecture, will have a capacity of 8 billion electron volts, the highest in the world.

So far, however, there apparently is no synchrotron radiation facility in Japan, or overseas for that matter, which has been built and operated solely through funding from industry.

The Japan Management Association says that "Companies can use government facilities, but then ownership of patents becomes a problem. Also, research results must be published, which makes it difficult to protect a company's proprietary information. This can be said to be an indication that research by private companies has reached a level where this kind of advanced equipment is required."

NTT Conducts Research on Quantum Effect Semiconductors

94FE0920B Tokyo NIKKEI SANGYO SHIMBUN in Japanese 26 Aug 94 p 5

[FBIS Translated Text] NTT Produces 10 Nanometer Width Silicon Fine Line, Confirms Quantum Effect at -173°

On 25 August, the Nippon Telegraph and Telephone Corporation (NTT) announced that it had succeeded in producing a silicon fine line with a width of only 10 nanometers (1 nanometer is one-billionth meter). The quantum effect, which is necessary for the next generation of advanced devices, was confirmed at a temperature above the temperature of liquid nitrogen, the highest temperature at which the function has been demonstrated thus far. The use of very fine structure and quantum effect will substantially improve integration and processing speed and open the way to realizing the next generation of advanced devices.

The fine line produced by NTT is several nanometers high, 10-20 nanometers wide and several tens of nanometers long. Its uniqueness is in the fact that it is made of silicon, a common semiconducting material. Silicon is appropriate for device integration because of its stable quality. In the past, fine lines have been produced with gallium arsenide and other compound semiconductors.

The fine line demonstrated the quantum effect, staged increase of current in response to injected current, at -173°C. In the past, it was claimed that it would be difficult to find the quantum effect with silicon fine line, and even compound semiconductors had to be cooled to -253°C, which precluded application to devices.

In NTT's process, a silicon thin film was layered on a layer of silicon dioxide, which had been set on a silicon substrate. Lithography technology was used to process the silicon thin film into fine line form; it was then heated so that the fine line surface became silicon dioxide. As a result, the core was not oxidized and became the finished silicon fine line.

NTT says that confirming the quantum effect at a temperature higher than the temperature of liquid nitrogen has increased the possibility of demonstrating that function at room temperature. Henceforth, the integration of multiple fine lines can be expected to lead to the development of memory devices with 1 tera (1 trillion) bit capacity and logic devices with substantially improved performance.

Japan Seems More Flexible R&D System

43070016A Tokyo THE NIKKEI WEEKLY in English 7 Nov 94 p 13

[Article by Junichi Taki, senior staff writer]

[FBIS Transcribed Text] While much attention is being paid to ongoing efforts to overhaul Japan's economic and political systems, similar attempts are being made to bring another ossified aspect of the Japanese system up to date: the way scientific research is conducted.

"The ability of Japan's universities to act as a source of new ideas has come into question," said Junjiro Kanamori, president of Osaka University.

The breaking down of barriers and the creation of a more open research environment is an important step in Japan's effort to boost its scientific competitiveness.

The industrial resurgence in the United States, for instance, can be partly credited to technological strengths derived from an inherently flexible research system.

Major Hindrance

In Japan, companies and universities are growing increasingly aware that the lack of flexibility in their own R&D systems is a major hindrance to the creation of innovative technologies and products. With an element of urgency, they have begun re-evaluating their R&D structures and trying out new ideas.

The changes are symbolized by Tsukuba Science City's attempts at revitalization and the official opening of Kansai Culture and Science City, home of the image-conscious International Institute for Advanced Studies (IIAS) and numerous research facilities.

There was a time when Japan congratulated itself for being the leading nation in robot technology, confident that it had surpassed the United States not only in robot applications but also in cutting-edge technologies.

But America has retaken the lead with achievements that include powerful RISC microprocessors, which have fueled the trend toward computer downsizing, and massively parallel processing systems for multimedia transmissions.

These are not simple additions to existing technologies, but completely new developments, and the feeling is growing that Japan should not allow itself to be just a follower.

Crossing Borders

In the United States, even prominent scientists move about between universities and the private sector, and there is an on-going mixing of people and academic disciplines. "The flexibility of this system fosters creativity," said Minoru Oda, IIAS director.

Japan's research system, meanwhile, focuses on finding faster and more efficient ways of doing things, which is not conducive to major scientific breakthroughs.

There is a growing sense that Japan needs to change its mind-set and create innovative technologies, rather than simply playing catch-up, observers said.

The University of Tsukuba, which just recently inaugurated interdisciplinary Tsukuba Advanced Research Alliance (TARA) Center is setting the trend. Under the leadership of Nobel Prize-winning physicist Leo Esaki, who has long sought to break the chains of Japan's university system, the University of Tsukuba is now promoting interchanges with government and private sector scientists, and encouraging greater participation from foreign researchers.

TARA is pulling together 500 scientists to create an organization of unprecedented size. "This could be a model for future cooperative efforts between academia, industry and government," said Toshiaki Ikoma, head of Texas Instruments Japan's Tsukuba Research and Development Center.

Cautious Steps

Even the University of Tokyo and Osaka University are beginning to add some flexibility to their research organizations. While their changes are not as daring as the University of Tsukuba's, they are noteworthy because both universities have traditionally maintained strict divisions between disciplines.

"The scientific concepts of the next century will come from the fusion of the natural sciences and the cultural sciences," said IIAS Chairman Michio Okamoto.

The Kansai Culture and Science City hosts some 30 research centers and universities, including private corporate labs as well as institutes which involve cooperation between the public and private sectors.

One cutting-edge institute of the latter type is the Advanced Telecommunications Research Institute International, where a markedly large 20% of the research staff is non-Japanese.

Also located in Kansai Culture and Science City is Matsushita Electric Industrial Co.'s Central Research Laboratory, where biologists are dreaming up new types of motors based on microorganisms and human muscles.

Lab director Koji Nitta sees nothing odd about a maker of household appliances involved in this type of research. "When the future is unclear, that is the time to stretch things," he said.

The scientists work on an annual contract basis, reflecting the quickly spreading view throughout Japanese industry that the traditional system of seniority and permanent employment is not appropriate in the science setting.

Summary of Report on International R&D Cooperation Policy by MITI's Industrial Technology Council

43070015A Tokyo INDUSTRIAL TECHNOLOGY COUNCIL in English 8 Jun 94 pp 1-10

[Article by International Research and Development Cooperation Committee, Industrial Technology Council, MITI]

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Comprehensive and Strategic International Research and Development Cooperation Aimed at a New Technology-based Nation

Part 1: Domestic and International Conditions Concerning International Research and Development (R&D) Cooperation

I. Trends in Japan

1. Economic Recession

Under the present persisting economic recession, private companies in Japan have been reducing their investment in R&D and international cooperative research (which is expected to decrease by 12% in FY94 compared to the previous year). This puts into serious question Japan's future R&D potential.

2. Shortage of R&D Personnel

Japan's population of young people is expected to decrease and they show growing preference for nonscientific and nontechnical careers. Japan's small and medium enterprises, in particular, are suffering from a serious shortage of R&D personnel. (A recent survey showed that 24% and 51% of companies suffer manpower shortage in the manufacturing sections and R&D sections respectively, and 36% of big companies and 53% of small- and medium-sized companies responded that they are short of R&D personnel.) The utilization of overseas R&D personnel will be a major consideration.

3. Increasing Need for the Creation of New Industry

There is a declining rate of new business establishments in small and medium enterprises, from 7% between 1960s and 1970s to 4% in recent years. This is seen with grave apprehension as an indication of a weakening of the entrepreneurial spirit of Japan's industrialists. In the United States, however, brilliant engineers of large corporations frequently spin off venture businesses. It is strongly hoped that "technology" from both domestic and foreign sources will play crucial roles in the creation of new industrial establishments in Japan.

II. New Trends in Promoting "International Cooperative Research"

1. Strengthening of the Relationship between "Technology" and "Economics"

The recent trends after the Cold War are characterized by the change of governmental policies of many countries to place more priority on technological development so as to vitalize their economies.

In international economic relations, we see an increase in transactions involving "technology" in addition to those involving goods and capital.

Governmental technology policies of many countries have been shifting their emphasis toward economic stimulation.

It will be essential for Japan to send out strong messages emphasizing that countries should not follow the tenets of "technology protectionism" which are based on the recognition that one company possessing advanced technology is likely to solely monopolize the market in the end.

It also becomes increasingly more important to engage in cooperation in the harmonization of industrial standards to prevent any bent toward "technology protectionism."

2. Growing Sophistication and Complexity of Technology

As industrial technological problems become increasingly more sophisticated and complex, capital resources and risks needed to overcome these problems will tend to increase. Therefore, international cooperation has been recognized as a more effective way of R&D.

3. Increase in the Problems Shared by Humankind as a Whole

It is necessary to take action to address common problems shared by humankind as a whole such as the problems of our global environment, earthquakes, volcanic eruptions, desertification and other natural disasters, the problem of AIDS, etc. With the end of the Cold War, there is also the important problem of ensuring the smooth conversion of defense industries to civil industries.

III. Growing Interest in the Free Flow of "Industrial Technology"

1. Assuring Free Flow of "Industrial Technology"

There is an imbalance in the exchange of researchers, for example in relation with the United States. Japan is sending 5-6 times as many researchers as it is accepting from the United States. There are greater calls for better access to the technology of the private sector and for fuller provisions to accept foreign researchers in public institutes.

There is increasingly greater interest in gaining access to Japan's technology. (The ratio of Japanese researchers sent abroad and foreign researchers accepted from abroad by private companies in Japan was 4.13 in FY92, 4.50 by universities and 1.07 by national research institutes.)

Japan has a deficit in technology trade, which is directly related to the Japan-U.S. Framework for a New Economic Partnership.

2. Growing Interest in Intellectual Property Rights

Interest in the proper protection of intellectual property rights and international harmonization in the patent field is growing very rapidly among the advanced industrialized nations. This is a very important issue in terms of the promotion of technology transfer to the developing nations.

IV. Expectations Placed on Japan for Making an International Contribution through "Industrial Technology"

1. High hopes for smooth industrial technology transfer

There are growing expectations among the international community for Japan to make a contribution through technology transfer as a "front runner" in the technology field.

2. Offering of knowledge and information concerning "industrial technology"

There are increasingly greater calls, primarily among the developing countries, for Japan to offer knowledge and information on how to formulate industrial technology policies and plan and execute R&D projects with the cooperation of the government and private sector. There are increasingly stronger demands also from the advanced industrialized nations calling for Japan to provide knowledge and information on how to smoothly implement cooperation schemes between the public and private sectors, notably between industry, government and academia, and the role of Japanese "public testing organizations" in enhancing the technological potential of small and medium enterprises in local regions.

Part 2: Direction of Future International R&D cooperation

1. Promotion of International Industrial R&D Cooperation Aimed at a "New Technology-Based Nation"

From the standpoint that Japan will play a leading role in the development of the world economy by creating new industries through new technologies, it becomes possible to recognize that the promotion of international industrial R&D cooperation is a necessity and the role demanded of Japan as an "International Trading Nation."

It is necessary for Japan, with a high level of technology forming the basis of its national survival, to strive toward a "new technology-based nation," making an international contribution through ensuring the free flow of "technology" and diffusing new "technology." Japan has been insisting on the importance of "techno-globalism" in this context. It will be important also in the future to initiate international industrial R&D cooperation on the basis of dialogue with all countries concerned.

II. Basic Philosophy for International Industrial R&D Cooperation

1. Provision of Bases for R&D and Researcher Exchange in Japan

It is necessary to create a Center of Excellence (COE), needed not only for Japan to contribute to international society in the field of industrial technology but also to upgrade the level of industrial technology in Japan.

2. Strategic Use of Joint Research

It is of vital importance to promote the long-term commitments indicated in item 1 above. For the further development of Japanese society, "technology" is expected to play a major role as an intellectual resource. Therefore, it will be necessary for Japan as a tangible and short- or medium-term measure to exercise a leadership role in promoting "international industrial R&D cooperation" centered on implementation of international joint research projects and promote cooperative relations between domestic and foreign companies, in order for the advanced nations to avoid resorting to "technology protectionism" based on such philosophies as the notion of "strategic trade policies." This is an important means for establishing an approach based on cooperation instead of confrontation and also practical alternative to the philosophy of "strategic trade policies."

Furthermore, international cooperative research will have a spin-off effect in producing new technologies through the fusion of domestic and foreign know-how. Considering the difficulties associated with individual efforts to develop new industries, international cooperative research clearly contributes to the rebuilding of existing industries and the development of new industries based on new discoveries (seeds of technologies), and eventually to a significant dynamism of the world economy.

Since we have seen cases in which international industrial standards have been applied as a means of international trade strategy, it is also important to promote international industrial R&D cooperation in the domain of standardization so as to ensure the sound development of international trade.

3. Free Flow of Technology and Offering of Technical Information

Considering the vital importance of "technology" as an intellectual resource for the nation, it is absolutely vital to ensure the smooth and unrestricted flow of the results of technology and technical information. For this purpose, it is necessary for Japan to make a concentrated effort to diffuse its technical information and at the same time remove access barriers to technical information. There is also the need to seek international harmonization of various countries' intellectual property rights systems.

4. Promotion of Industrial Technology Transfer

There is the need to make efforts on all fronts in connection with offering information covering Japan's high level of "industrial technology." These efforts should include strengthening policy dialogues with countries concerned.

5. Commitment Toward Solving Global Problems

It is also essential for Japan to show initiative in terms of coming to grips with global problems shared by the whole of humankind, including the problems of our global environment and measures to defend ourselves against natural disasters. International programs such as the "New Earth 21" program in the environmental field and natural hazard mapping should be promoted in this connection.

It is also necessary to give fuller consideration to expansion of "grant" programs including the Human Frontier Science Program and the International Joint Research Grant Program administered by the New Energy and Industrial Technology Development Organization (NEDO).

Part 3: Means of International R&D Cooperation

I . Role of Industry, Government and Academia in International Cooperation

It will be necessary to promote cohesion between private industry, government and academia so as to carry out

international industrial R&D cooperation, while giving the most serious consideration to the roles they should play. Their respective roles can be summed up as follows.

(1) With national research institutes, it is easy to engage in cooperation on an organizational, on-going, and long-term basis.

(2) Universities do not solely concentrate on basic research but also engage in applied studies that may have profound effects for society. Not only playing an important role in nurturing human resources, universities will also expand their role in R&D cooperation.

(3) Private companies hold a reservoir of extensive management resources (innovation, management know-how, etc.) with the capability to follow through the R&D stage close to commercial application. They also hold the key to industrialization.

In view of these specific roles each of the above three sectors play, we can say that it is necessary to achieve and maintain a triad of cohesion between "government-industry-academia" to promote and further cooperation projects responding to international needs, with "government" called upon to act as the coordinator to help "academia" and "industry" bring out the best results in the fields where they excel.

In this sense, it is also necessary to consider what deregulation measures might be necessary to ease the conditions which restrict the activities of government and academia.

II. The Five Principles of International Cooperation

The following five principles are important in the actual pursuit of cooperation under government initiative.

(1) It will be essential to seek and achieve innovation by constantly bearing in mind that the cooperation should make a contribution to the consolidation of industrial competitiveness for the participating countries in the cooperation as well as to the development of the world economy.

(2) The areas in which cooperation is extended should be fields in which the nations concerned can complement each other. These fields of technology should be in a precompetitive stage.

(3) For promoting joint R&D projects, the private sector should be encouraged to participate in them so as to make use of their knowledge and know-how. Consideration should be given to a fully integrated approach spanning the entire process from locating the themes of cooperation to the diffusion of the results.

(4) Before the partners of cooperation engage in cooperation programs, they should reach agreement on the way to treat and share the results of their joint research on an equitable basis and make the greatest possible effort in diffusing these results.

(5) Cooperation should start with an open dialogue and the door should always be left open for the participation of interested third parties. Consideration should be given, in particular, to the promotion of technology transfer to the developing countries.

III. Promotion of Comprehensive R&D Cooperation in the Mid-term Perspective

It has been pointed out that the Japanese government should increase R&D expenditures and promote upgrading of R&D potential. Considering the recent situation where Japan has been expected to play a major role in promoting international R&D cooperation, it is increasingly important for the Japanese government to strengthen its effort drastically in the field of R&D policy.

For this reason, it is necessary to promote international joint research in the field of industrial technology (the FY94 budget proposal includes ¥45.4 billion for this purpose), expand the provisions for inviting researchers to both the national and private research institutes (AIST invited 150 foreign researchers for over 6 months each to its research institutes in FY94), and to present and defuse technical information by carrying out comprehensive measures including allocation of significantly more funds and strengthening of the systems. Furthermore it is important to make a plan to execute the above mentioned measures from a mid-term perspective.

Part 4: Regional Development of International Industrial R&D Cooperation—Practical Policy—

1. Direction for International Industrial R&D Cooperation With the Advanced Industrialized Nations

1. Further Promotion of the Exchange of Researchers

(1) To ensure that the International Industrial Technology R&D Cooperation Center (Techno Growth House), which is scheduled to start operation from next fiscal year, can engage in effective and fruitful activities, we will conduct discussions by specialists concerned from both Japan and abroad, including the United States.

(2) A system for inviting researchers from abroad shall be upgraded.

(3) A "U.S.-Japan Industry and Technology Management Training" program shall be strengthened and cooperation efforts shall be made in establishing the conditions required for expansion of the circle of companies coming into the scheme, including the advertising and PR activities to achieve this, and also in matching of foreign researchers with host companies and funding, for the program.

2. Promotion of International Cooperative Research

(1) In conducting cooperation, attention should be concentrated on the industrial generic technologies which are capable of forming the basis for industrial development.

(2) The provisions made for dealing with intellectual property rights in the Intelligent Manufacturing Systems (IMS) and Real World Computing (RWC) shall be a model for future international industrial R&D cooperation projects.

(3) Supporting programs shall be implemented to promote joint research in the private sector (45.6% of joint R&D in the private sector is not actually joint R&D but just commissioned research).

(4) Efforts shall be made to ensure transparency for overseas companies and provide domestic and foreign interested parties with an equal chance to participate in R&D projects based on the principle of nondiscrimination.

3. Ensuring a Smooth and Unrestricted Flow of Japan's Technological Information

(1) Consideration should be given to the transmission of important technical information to the governments of other nations on a regular basis through the cooperation of the Japan Industrial Technology Association (JITA) and other organizations.

(2) The Electrotechnical Laboratory of AIST is to start its technological research information service with the Gopher (INTERNET) System. Other research institutes organized under AIST will be required to make the same kind of effort. Efforts shall also be made at the universities and other research institutes to create research information networks linked up with INTERNET.

(3) Parallel with the Techno Growth House, there shall also be a Technological Information Office for the benefit of overseas engineers and researchers. This Office shall function as a technology access. Consideration shall also be given to the creation of similar facilities in other technology-intensive regions of Japan.

4. Other

To achieve a deeper mutual understanding with our partners abroad, provisions shall be made to intensify a direct dialogue between the "International Research and Development Cooperation Committee of the Industrial Technology Council" and those responsible for technology policies in the various foreign countries concerned. Efforts shall be made on a regular basis to diffuse policies information through the holding of "Industrial Technology Policy Forums" composed of Foreign Embassies, Chambers of Commerce, etc., and consideration shall also be given to strengthen support for activities designed to bring about a deeper and better international understanding within academic societies (learned societies).

II. Direction of International Industrial R&D Cooperation with Developing Countries

1. Promoting of Joint Research in the Industrial Technology Field

(1) Promoting of Joint Research Among National Research Institutes

Joint research shall be promoted in the industrial technology field in accordance with the needs of various nations and regions.

(2) Promoting of R&D Cooperation to Facilitate the Development of Supporting Industries

Activities shall be made for the development of local industries in materials related technology, parts machining technology, etc., and the development of the locally available natural resources.

(3) Assuring the Continuity and Consistency of R&D Projects

It will be necessary to reinforce schemes which will lead to appropriate private sector cooperation in those areas for which commercial development has become a practical goal.

(4) Rules for the Handling of National Assets

Within the context of governmental R&D cooperation, consideration should be given to a system permitting the transfer on a gratis basis of testing and research facilities and equipment brought by the partner research institutes to the local community.

2. Strengthening the Cohesion With Local Companies and Foreign Companies in the Developing Countries

While giving every consideration to the development of an international division of industry, it will be necessary for foreign companies to strive for an appropriate sharing of the burden with the local and indigenous companies in accordance with policies and visions for the industrial structure held by the countries concerned.

3. Positive Exchange of Technical Information and Researchers

(1) Positive Exchange of Researchers and Technical Information

It will be necessary to make positive provisions so that Japanese national research institutes may accept foreign researchers from developing countries who will and should play a leading role in the development of human resources in their countries.

(2) Positive Use of Japanese Experienced Engineers

To ensure that the valuable technological knowledge and skills of experts are effectively utilized and applied for the development of human resources in the developing countries, it will be necessary to make policy provisions for the creation, in the developing countries, of opportunities for highly experienced engineers to transfer industrial technology to the countries concerned.

4. New Cooperation Aimed at the Realization of Policy Goals in Developing Countries

It will be necessary to provide the technological know-how such as technology management. For the purpose of technology transfer, it will also be essential to make efforts in the area of policy management, including the formulation of visions for policies on industrial structure and creation of a system for government-private sector cooperation at the local/regional level.

5. Creating the Framework Conditions for Promoting the Smooth Progress of R&D Cooperation

(1) Establishment of a Multilateral System of Cooperation

It will be essential to utilize multilateral international conferences such as the Asian Pacific Economic Cooperation (APEC) Ministerial Meeting and the meeting between ASEAN Economic Ministers and Japan MITI Minister (AEM-MITI) so as to bring about multilateral cooperation.

(2) Improvement of an Industrial Technology Information Network

It will be necessary to promote joint research through the use of networks and databases.

(3) Support for the Establishment of an Appropriate System for the Protection of Intellectual Property Rights

Cooperation should be extended in offering information and knowledge on matters related to intellectual property rights, in the establishment and diffusion of the rules for handling intellectual property rights on an international scale in the business sector, and among the public in the developing countries.

(4) Achieving Closer Cooperative Relations in Standardization Areas

Since industrial standards form a common basis for R&D, it will be of paramount importance to promote cooperation in Asia in the field of standardization from the standpoint of strategies for global standardization.

III. Direction of International Industrial R&D Cooperation With the Countries Developing Toward a Market Economy (primarily the region of the Former Soviet Union)

1. Approach Toward European Russia (Moscow and other areas)

It will be essential to maintain the framework for multilateral cooperation and give particular attention to the issue of conversion from military to civil industry. For this purpose, consideration will be given in the future to mid- term programs to meet these needs. Cooperation in the operation of the International Science and Technology Center in Moscow is important.

2. Approach toward the Far East Region

(1) It will be necessary to promote research cooperation in a positive manner in those fields of industrial technology which are capable of acting as the basis for economic development in the regions concerned. There is also a need to extend "Japan Industrial Technology Training Program for Small and Medium Industry in Russia" including the advanced machining technology field. It will also be absolutely essential to have an appropriate follow-up system to ensure that new industries can take root.

(2) It will be necessary to select the appropriate themes and prepare proposals for joint research with a view to upgrading "industrial technology," that is creating industrial potential. It will then be necessary to enlist the active cooperation of local companies, giving full consideration to the need for transferring the technological results or achievements to, and for the benefit of, the industrial community.

(3) To give companies the power to compete, it will be necessary to bring about corporate organizational reform through establishment of a R&D department.

Afterword

It can be said that setting up policies of comprehensive and strategic international industrial R&D cooperation and their complete execution will lead to establishment of new and meaningful economic and external policy measures in Japan.

Japanese Company Provides Air Pollution Control Technology to Chinese Petrochemical Company

94FE0759A Tokyo NIKKAN KOGYO SHIMBUN in Japanese 27 May 94 p 27

[Text] Miura Chemical Equipment Co. has provided the manufacturing and marketing rights on air pollution prevention and filtration equipment to Feilong Air Conditioning and Purification Equipment General Factory of Chengdu City (Chengdu, Sichuan), an environmental equipment manufacturer. "It is the first time that a Japanese manufacture of this industry has provided technology to a Chinese manufacturer," says Mr. Wong, the president of the Chinese firm. While the smoke from power stations in China is alleged to be the source of the acid rains that fall in Japan, this development is going to be a meaningful one, as it is expected to bring about the popularization of such equipment in China once such equipment begins to be built locally, and will help reduce air pollution.

The manufacturing technology is to be provided devices that process soot/dust, smoke, and toxic fumes at power stations, cement plants, and steel mills, as well as the liquid/solid separation devices for handling the waste water generated by each process. The royalty is 5 percent, and the period is five years. As a result, the factory is going to change its name to Chengdu Miura Chemical Equipment Company in late June. About 50 Chinese employees will be sent to Japan each year for technical training, and Japanese technical supervisors will be sent to China as needed. The Chinese concern expects to receive orders amounting to an equivalent of about ¥120 million in the first year and expects to start production in 1995.

While there are approximately 700 steam power plants in Sichuan Province alone, only about 10 percent of all the coal-burning stations are equipped with desulfurizing equipment.

When then-Prime Minister Hosokawa visited China in March 1994, the governments of the two countries declared their commitment to the solution of environmental problems, including the announcement that they had reached a final agreement on the implementation of the Environmental Protection Treaty, as well as the inclusion of a statement about the preference for investments in environmental countermeasures in the 4th Yen Credit Agreement.

The transfer of such environmental protection technology should "have realistic impacts on the environmental improvements of the two countries," according to Mr. Miura, the president of Miura.

Petroleum Association of Japan To Send Mission to China To Exchange Petroleum Refining Technology

94FE0759B Tokyo NIKKAN KOGYO SHIMBUN in Japanese 3 Jun 94 p 27

[Text] The petroleum industry of Japan has decided to send a mission to China this fall. The mission was planned primarily by the Petroleum Association of Japan for the purpose of opening the door to the exchange of petroleum refining technology and in the marketing area. China is said to be interested in cooperation with the Japanese in the field of refining technology because it is increasing the import of crude oil from the Middle East; whereas the Japanese petroleum industry, under the pressure of liberalization, is becoming more attracted to the Chinese market. The industry plans to have technology exchange starting with the dispatch of the mission and to promote a joint venture with China in the future [text missing] will be headed by [text missing] and consists of the senior executives of the industry.

According to informed sources, China has become a net crude importing country as the result of a surge in the consumption of petroleum products, so it is interested in the Japanese refining technology, which is considered the best in the world when it comes to the Arabian crude oil refining. On the other hand, the Japanese petroleum industry is strongly attracted to the Chinese market. The Majors and Saudi Arabia have already announced their interests in "having direct access" to China, so that there have been some concerns about the Japanese industry being left behind. It looks as if petroleum companies here will intensify their efforts to secure business opportunities in China, beginning with the dispatch of the mission this fall.

Japanese Company Provides Forging Furnace Technology to Korean Company

94FE0759C Tokyo NIKKEI SANGYO SHIMBUN in Japanese 5 May 94 p 27

[Text] Sanken Sangyo (Hiroshima), an engineering company specializing in the design of various types of industrial furnaces is providing four areas of technology, including the design technology for large forging furnaces, to Sanzenri Machinery, a major industrial furnace manufacturer in South Korea. Sanken Sangyo is transferring its marketing rights for the four related product areas in South Korea as well. The contract fee is ¥40 million, plus 4 percent of the sales to be paid as a royalty.

In addition to the above, Sanken Sangyo is said to be planning to send out some of its works to Sanzenri Machinery as subcontracts, as it is beginning to be busy with the industrial furnace orders from South East Asia, thus making Sanzenri Machinery as its exporting base for South East Asian countries.

What was provided this time includes the design technology of continuous billet furnaces for steel rolling operations, large forging furnaces, and continuous heat-treatment furnaces for pipes, as well as the ON-OFF burning technology used for keeping the furnace temperature uniform. The contract period is nine years, starting December 1993. Several engineers will be dispatched by Sanzenri Machinery for training. Sanzenri Machinery is expecting a sales increase on the order of about ¥500-1000 million per year because of the involvement in the area based on this technology transfer.

Although Sanken Sangyo has been marketing its products in South Korea on its own, it is transferring its marketing rights in those four areas to Sanzenri Machinery. Sanken Sangyo will continue to hold on to its marketing regarding other areas such as aluminum melting furnaces and trolley-type heat-treatment furnaces.

The demand for industrial furnaces is rapidly rising in South East Asia, and they have no choice but to switch their subcontracts from domestic sources to overseas sources because of the problem of the stronger yen; Sanzenri Machinery will be their subcontractor for the export to the South East Asian market.

Under their cooperative scheme, Sanken Sangyo will be in charge of marketing in South East Asia, as well as designing and engineering, while Sanzenri Machinery will be in charge of production for said area.

Their targets are Japanese automotive-related companies that transplanted their production in South East Asia, as well as Chinese steel manufacturers. Their ultimate goal is to increase the export orders from the current ratio of 10-15 percent to 25 percent within five years.

PEC To Cooperate with China on Environmental Conservation Projects

94FE0759D Tokyo NIKKEI SANGYO SHIMBUN in Japanese 9 May 94 p 12

[Text] Chiyoda Chemical Engineering & Construction Co. and Petroleum Energy Center (PEC) have jointly received an order to establish a joint venture for energy conservation and environmental protection in China. The two organizations are going to work together in developing a technology to reuse the exhaust gas from oil refineries by converting the gas to electricity as a part of the model enterprises to be implemented by New Energy Development Organization (NEDO). The business scale of the business is about ¥2.5 billion, and the construction is estimated to be completed within about 30 months; it is planned as a three-year project starting this year. Chiyoda is going to concentrate on soliciting environmental protection-related businesses for developing countries.

This model business is to install a power recovery device to be built into the main unit of the FCC (fluid contact cracking device) of the Shengli Refinery (production: 7 million tons/year) located in Qilu, Shandong Province, China in a cooperative effort involving NEDO, the National Planning Committee of the People's Republic of China, and SINOPEC (Petroleum Center of China).

Chiyoda Chemical is going to be responsible for the petroleum refinery engineering, while PEC is going to be responsible for the training of the operators and maintenance personnel.

It is a system to generate electricity by operating an expander turbine that uses the exhaust gas generated from the FCC regenerating tower, which evaporates heavy oil at a high temperature to produce high-octane gasoline and light oil. By saving electricity and trapping catalytic particles that contain heavy metals that have been released into the atmosphere, it contributes to the protection of the environment.

Chiyoda Engineering also received this year, in coordination with the Engineering Promotion Association from NEDO, an order to construct a simplified desulfurization device for the Changshou Chemical Plant in Chongqing, China, as a part of the Clean Coal Technology Model enterprises, whose objective is to support the efficient use of coal and prevent environmental pollution. It expects that there will be many environmental projects in China and South East Asia, and it is intensifying its participation in those projects through technical cooperation.

NTT Changes Overseas Procurement Policy

Some Inconsistency Seen

95P60052A Tokyo NIKKEI SANGYO SHIMBUN in Japanese 8 Nov 94 p 1

[FBIS Translated Text] Nippon Telegraph and Telephone Corporation (NTT) announced revisions to six elements of their international procurement procedures. The announcement was made to coincide with the agreement reached in the U.S.-Japan Economic Framework Talks. The most significant point was that NTT has officially "opened the door" for creation of an actual international standard (de facto standard). Some observers describe this development as an inevitable revision in policy line for NTT, which in the past has insisted on in-house development of its own technologies, now that they are a private company. On the other hand, questions still persist over whether the overly protected R&D groups will really change their way of thinking. Also, there is the possibility of renewed friction in the US-Japan dialogue if less progress than expected is made toward adoption of de facto standards.

Relaxation of "Tight Restrictions"

What products do private companies purchase and how much do they pay?—Although NTT is supposed to have developed highly flexible corporate standards now, it has maintained many of the old restrictions. For example, when a new large digital exchange was purchased, detailed specifications of the exchange and the purchasing procedures were to be announced 50 days before the application deadline. That information is reported in the public media and published by the U.S. Department of Commerce and EU Commission. It is an extremely restrictive procurement practice commonly known as "the track." The international procurement procedures initiated in January 1981 during NTT's period of monopoly continued on even after the company's privatization in 1985 and continued to increase when calculated in yen. It has shown rapid growth, especially during the past 5 to 6 years, reaching 119 billion yen in FY93, the first time the procurement reached the 100 billion level. Included among the major products procured were digital exchanges, fiber optics, and computer related equipment. The six revised measures announced on 7 November included:

1) Provision of information on major procurement as soon as possible;
2) Requests for product information before procurement;
3) Requests for opinions on specifications prior to procurement;
4) Consideration of international standards in terms of technological specifications;
5) Clarification of evaluation criteria;
6) Holding of briefings before applications. In short, NTT is trying now not to perpetrate its own specifications on its suppliers, but rather to reflect the information and opinions collected in advance of placing the orders.

NTT said that it took over 6 months for them to announce these specific measures due to continuation of in-house negotiations on the extent to which specific information can be revealed, based on their "Thoughts for International Procurement" which was reported in late March 1994 by NTT. The main points of the revision are simple, but the inter-governmental document addressed to Trade Representative Kantor of the USTR includes a 10 page long supplementary document in English. The latest revision was made in overall procedures to make it much easier "to purchase good quality products at a reasonable price." However, when examined individually, various inconsistencies emerge. Look, for example at the morale and patterns of activities of engineers, including those in the R&D sections. NTT is proud of the enormous quantity of orders it has processed and facility investment totaling nearly ¥2 trillion per year. NTT is blessed with both abundant human resources and ample funds which enables them to produce any product they want. This accounts for the pride NTT engineers take in boasting that "NTT has nurtured Japan's technology."

Focus Still on National Interest

NTT did not clarify the kind of de facto standard to be used. But if the new standards are used aggressively choices will increase, leading to advantages for business. However, from another perspective, it could mean that it is possible that the standards developed by NTT's researchers and engineers will prove unworkable. This might, in turn, reduce worker morale. Expansion of de facto standards means that NTT's "overly protected" engineers definitely will have to change their way of thinking. However, the R&D section, that part of NTT that "exists farthest from the privatization initiative" (per NTT sources), still focuses on the national interest. It is hard to believe that NTT can change drastically the path of in-house development which has been its company policy since NTT was a public corporation. It is hard to predict how effectively the latest revised measures will work out. Even if they are implemented smoothly, it is still uncertain whether NTT can control ever increasing competition for usage in the operational section. It looks like NTT's extremely strong interdependent relationship with "NTT family" manufacturers throughout Japan will have to be reexamined. Joint development with NTT was advantageous to those manufacturers in the sense that "it provided opportunities for them to obtain communications technical know-how from the world's largest development group." However, there were some negative as well. The technologies developed were limited to the "NTT standard = Japanese standard" which did not fit the world market. NTT methods have never been used overseas in the past, and therefore Japanese manufacturers have never had a chance to mass produce. Traditionally, NTT purchased products at reasonable prices even if they were developed at high cost by former NTT family manufacturers. Therefore, the manufacturers still enjoyed good profits. However, NTT has begun to insist on procuring products cheaply from abroad, reducing profit margins at home. The manufacturers eventually had to face profit losses for the products they delivered.

Resale Permission Required

When it comes to the domestic market, "NTT's permission for resale" is restricted. Products produced jointly with NTT are reportedly prohibited for sale under the manufacturer's name without NTT's permission. As far as the manufacturers are concerned, OEM products supplied to NTT are also "sales." But they were not comfortable

sending the products through their own sales routes. NTT's adoption of de facto standards means that the traditional "dependency system" is being accepted less and less and manufacturers will be exposed to keen competition internationally. This will provide them with the incentive to diversify their business away from excessive dependence on NTT. NTT and the government steadily opposed adoption of numerical targets for international procurement. Even at the conclusion of the latest Framework Talks, both Tokyo and Japanese companies maintained that position. However, if adoption of de facto standards fails to produce the level of progress anticipated, it could become a new source of friction. NTT's international procurement funding is expected to decrease from 1997 after the digital networks are completed. The latest measures may be offered as the basis for discussions expected during the anticipated renegotiation at that time.

NTT's Fiber Optic Network Program

To Reach 20 Percent Saturation by Year 2000

95P60052B Tokyo NIKKEI SANGYO SHIMBUN in Japanese 5 Dec 94 p 7

[FBIS Translated Text] Nippon Telegraph and Telephone Corporation (NTT) announced plans for development of its optic fiber network program by the year 2000. Twenty percent of the access networks just prior to the user terminals that connect NTT's exchange station circuits will be replaced with fiber optics. This is the first time NTT has disclosed specific intermediate plans since the company announced its "Fiber-to-the-Home" (FTTH) program to establish fiber optic networks for all homes by the year 2015 at a cost of 45 trillion yen.

According to the program, fiber optic networks will be installed in 30-40 percent of government designated cities, prefectural capital cities, and equivalent metropolitan cities, and in 5-10 percent of the cities with populations of over 100,000. Government designated cities by 1997 and cities of above 100,000 population by the year 2000 will be 100 percent equipped with fiber optic networks.

Investment in the fiber optic networks will amount to approximately 2 trillion yen. In the year 2000, 120,000-130,000 kilometers of optic fiber access networks will be available, about 8 times longer than that in place at the end of March 1994 (15,281 kilometers).

Itochu To Sell Information Network Encryption System

95P60052C Tokyo NIKKEI SANGYO SHIMBUN in Japanese 7 Dec 94 p 1

[FBIS Translated Text] Itochu Corporation has formed a business alliance with Wanbishi Archives [phonetic] (President Tsukasa Kurita, Chuo-ku, Tokyo), a corporation in the business of storing secret documents. The new venture will sell encryption systems that improve the safety of corporate information networks. Their encryption system can encipher and decipher information exchanged on LANs (local area network) preventing outsiders from invading the networks. Wanbishi will take charge of development. Itochu will officially enter the security-related market through operation of storage facilities for secret documents.

Prevention of Security Leaks

The encryption system recombines arrays and notations according to a special algorithm. Information customers enter into their terminals will be enciphered and forwarded to a computer at the security company where it will be archived. Then, when the customer needs the information again they can recall it to their own terminals and decipher it to recreate the original arrays and notations.

A series of operations can be carried out by connecting the encryption system and its proprietary software to IC cards. The algorithm used here was developed by the SLA Corp. in the U.S. The IC card, which follows the international "PCMCIA" standard, can be used on any drives that use the same standard.

The business world is creating more versatile information. For example, it is becoming increasingly popular for sales people to send information through public circuits from wherever they happen to be from their portable terminals, linking up with other communications networks such as the Internet. This development also provides hackers with more opportunities to invade the systems, making efforts to maintain security a more popular topic. It would be difficult to read data from the new system once it has been enciphered even if the network were invaded. This makes the system more secure than the more common use of passwords.

The price is set at ¥30-50 million depending on the level of the network. Processing for encryption takes about as long as it takes to enter the information into the recording media.

In addition, Itochu will sell the electronic control cabinets and enter/exit room control systems for maintenance of secret documents that Wanbishi has developed. The cabinet system records who used the document and when, making it ideal for new pharmaceutical development businesses with their strict enforcement of document maintenance. First year sales of all of the products are expected to reach ¥3 billion.

Wanbishi's main business is storage under contract of secret documents from companies and government agencies. Wanbishi is trying to develop products suitable for information systems to diversify their business, deciding to tie up with Itochu to avail themselves of their better sales capabilities.

JDA To Develop Electronic Countermeasure System

To Be Applied to Fighters

95P60053A Tokyo NIKKEI SANGYO SHIMBUN in Japanese 30 Nov 94 p 12

[FBIS Translated Text] The Japan Defense Agency (JDA) will start a project in FY95 to develop an electronic countermeasure system (ECM) to be used in fighter aircraft. Approximately 800 million yen has been included in the FY95 budget proposal. It will take three-four years to produce a prototype and to install the system in F15s, Japan's main fighter in the future. Success or failure of air battles in this day and age is determined by capabilities such as radar and radio guidance missiles. ECM systems confuse enemy missiles by sending strong interference radiowaves. Conventional ECM systems operate from aboard aircraft, but the new ECM ejects from the aircraft, causing enemy missiles to veer off their intended path. This feature also helps to prevent enemy radar from identifying them by tracing back the interference radiowaves emitted. Since the launching aircraft cannot supply power to the unit once it is launched, the new type of ECM system must be not only small but also contain its own source of electricity. JDA conducted research on the new ECM system between 1990 and 1992. The requirements for performance were met at the research stage, and therefore development plans were made official.

MHI Suggests that JDA Use New Missiles

95P60053B Tokyo NIKKAN KOGYO SHIMBUN in Japanese 13 Oct 94 p 1

[Text] Mitsubishi Heavy Industries, Ltd. (MHI, President Kentaro Aikawa) has reportedly proposed that the Japan Defense Agency use 2 new missiles for the Air Self Defense Force. The Defense Issues Forum (Chairman, Asahi Breweries, Ltd. Chairman Kotaro Higuchi) had previously submitted a report suggesting the use of the theater missile defense (TMD) system in connection with the high-tech and modern equipment. MHI seems now to have realized that it is important for the Japanese defense system to adopt new equipment in the missile area which is said to be weak in defense capability. The 2 newly proposed missiles, which have been under devlopment by U.S. companies, include the latest version of the ground-to-air missile Patriot "PAC-2" which MHI is hoping to produce under license, and a long-range air-to-air missile "AAM-5" (tentative name) which MHI had intended to develop domestically in Japan. MHI is asking JDA to allocate funds for the missile development in the FY96 budget, the first year of the JDA's next-term defense-buildup program. JDA has been reviewing the status of a new defense plan now that the "East-West Cold War" has ended, and therefore intends to carefully study MHI's proposal. According to JDA, Japan does not now own missiles capable of intercepting the North Korean intermediate-range "Nodong" ballistic missile, which includes Japan in its range. This is one reason why MHI proposed use of the new missiles.

Nissan Develops Missile Flight Control Technology

Launch Test in Two Years

95P60053C Tokyo NIHON KEIZAI SHIMBUN in Japanese 6 Oct 94 p 1

[Text] Nissan Motor Co., Ltd. has developed missile flight control technology applicable to antiballistic missiles. Nissan will ask the Japan Defense Agency (JDA) to allocate budget for its development and conduct a launch test as early as two years from now. Development activities under the theater missile defense (TMD) initiative by various manufacturers in the U.S. are well under way. Missile flight control technology is especially popular as a subject of development efforts. Nissan is conducting research on high velocity solid fuel rocket propulsion missiles. When approaching close to the target, the missile emits combusted gas through over 100 "side thruster" holes located on the side of the missile controlling the path to the target. Compared to conventional methods which rely on wing movements, the new missile will have greater mobility and controllability even at high altitudes where air density is low. Nissan has already conducted combustion ground tests for a propulsion rocket under the high pressure of 200 kilograms per 1 square millimeter. Side thruster emission tests have also begun. It is reportedly "possible to conduct launching tests in as early as two years" (per MHI officical). As of now, applications including antitank and anti helicopter missiles are under consideration. Its relative speed in relation to targets is approximately Mach 4-5. If the combustion pressure could be raised by 20-30 percent using thermal resistant materials, the speed will improve to about Mach 9. Other application includes missile interceptors. The United States is appealing to Japan and European countries to join the TMD initiative in light of the ballistic missiles owned by North Korea. The side thruster control is also used on the "ELINT" missile which is under development as part of the TMD initiative by the Laural Boat Co. [phonetic], U.S. Development costs of approximately 1 trillion yen are estimated to achieve the TMD initiative. It is the only on-going mega project during a period of overall defense budget reduction. U.S. and European companies are the front runners in development, but the U.S. has asked Japan for funding and technoligical cooperation.

Officials Discuss Military Satellite Use

OW0512080994 Tokyo BOEI GIJUTSU JANARU in Japanese Nov 94 pp 4-10

[Interview with Dr. Toshifumi Sakata, professor, director of the Research & Information Center and director of the Tokai University Space Information Center, by Izumi Tomita, director general of the Defense Technology Foundation; place and date not given: "The Importance of Intelligence Functions Indispensable for Security".]

[FBIS Translated Text] Several Conversations and Discussions Needed

[Tomita] A politician has said that Japan must have its own intelligence gathering functions. Until now, the United States has kept Japan almost entirely under the terms of the Japan-U.S. mutual cooperation and security system and it is

said that everything has been based on information provided by the United States. Some electronic signals intelligence has been acquired by Japan itself and there were times when Japan actually provided such information to the United States. But Japan does not have any reconnaissance and intelligence gathering functions using satellites. This kind of intelligence is ready-made by the United States, selected by them from the range they find appropriate to be provided to Japan, and the interpretation of the provided information is left to Japan. In this way it is difficult for Japan to obtain the military reconnaissance information it really needs. And because there has been a Diet resolution on the use of space, it is difficult for the Defense Agency to conduct research into it. The Defense Agency has its Technical Research and Development Institute, but it is said that it leaves this subject untouched. I do not know where the boundary between the peaceful use and military use of space is. It has been said that observing the earth from high up in the sky and analyzing the acquired information falls into the domain of military use, but politicians have started to discuss about how such use differs from peaceful uses. As a result, opinions that Japan should own its own reconnaissance satellites are sometimes seen in newspapers today.

By the way, Japan's satellite developments cover remote-sensing satellites and marine observation satellites as well as meteorological satellites and communications satellites, and I think that the technical potential of Japan has become very high. As one of the destinations of such technology, one of my main interests lies in how great is the difference between the situations of major countries which provide their satellites with military or defensive reconnaissance functions and the current situation in Japan. I also have naive questions such as, when the various restrictions surrounding Japan are removed, will we still have to buy American equipment entirely or can we develop the equipment ourselves. For satellites themselves, I know that Japan's technical level has improved considerably through satellites developed until now. I would like to hear your opinion about the difficulties of satellite- borne sensors, information transmission and reception functions and the analysis functions of information received on the ground, how difficult they are from the current technical level of Japan and how they can be positioned in the technical perspective.

[Sakata] The first problem is that, unfortunately, intelligence gathering is positioned low in the priorities of the national defense system. The reason why this function is underdeveloped may be due to certain preconditions, including excessively political considerations or strong dependence on the United States, or, on the contrary, a too extensive secrecy or the absence of conversations due to fear of critical public opinion. It is possible to discuss technology almost infinitely, but the biggest problem lies in the constitution of organization itself. I think that it is almost impossible to discuss Japan's intelligence technology without considering this problem. Specifically, gathering information in the framework of defense is the basic issue. However circumstances may change, this basic issue will never change.

[Tomita] I think that the weakness of Japan's defense capability or the will of Japan to defend itself has also been felt by people in general. And this is why people were suddenly alarmed and became agitated when you said "there is something strange over there" about North Korea.

[Sakata] I think that the sensation was because of the lack of international awareness among the Japanese people, who had been indifferent to things happening in North Korea. The second viewpoint is that Japan should take the initiative as a source of the international transmission of intelligence rather than domestic transmission. The third point is that mentioning the data on North Korea, that is, the nuclear facilities in Yonbyong, was strategically advantageous for promoting a recognition of the importance of accumulating such technology as well as experience.

[Tomita] Was the source of that data SPOT?

[Sakata] Not only that. I use various data, including Landsat data. Just using SPOT is not enough. Recently I have also used Russian data.

[Tomita] Can such data be readily obtained?

[Sakata] Yes. It was earth observation satellite data. They are internationally open and unlimited, and we just have to buy them. And data on North Korea is receivable from Japan. Tokai University is the only university in the world that owns a receiving station, and we receive the data in Kumamoto. Anyway, the extreme importance of intelligence for defense is historically very obvious, and I believe such a system should be built as a national system. But the action taken towards that end is rather slow. Among the various types of intelligence, basically the most correct is precise analysis of public information. Intelligence in the form of espionage activities as in the old days is difficult. Public information naturally includes propaganda and various information that is intentionally deceptive, but it still allows us to grasp the overall current easily. Since the analyses we make are based on public information, at least information at the same level as ours may be obvious to the Defense Agency.

[Tomita] I think the Defense Agency is naturally making use of public information.

[Sakata] But, frankly speaking, they are bad at public relations. Their way is to keep everything to themselves, almost refusing to disclose anything. The United States is clear on that point. They make open things which should be open but also affirm the things which will not be made open. Meanwhile, Japan classifies everything as confidential. I think this point indicates the awkwardness of Japanese public relations activities. Making information open is extremely important. "We take such a stance to prevent misunderstanding and therefore we will not make this point open"—such a stance is not made clear. I think there has not been enough discussions on the reason why each piece of information should be open or not.

[Tomita] Certainly, I also feel that Japan must do more to promote necessary public relations.

[Sakata] Military intelligence gathering covers electronic signals intelligence, and information on various movements can be gathered from many possible routes. Meanwhile, reconnaissance activities using aircraft are possible inside the national territory and over the high seas because certain

reconnaissance is permitted in these areas. But the circumstances suddenly get difficult once the intelligence goes beyond national frontiers. In the 1950s after World War II, when the Cold War structure was formed as a result of increasing tension between the United States and the Soviet Union, countries decided not to show information to each other. Particularly, the socialist countries were closed and became invisible. In the Western European and American societies, people were free to move, photography was allowed except in special places, and maps were available. In consequence, the side which was not open became more eager to know things. The trend in the fifties was to hide information, and it was the time when reconnaissance activities started. The targets of reconnaissance were naturally nuclear facilities (where hydrogen bombs may or may not be produced), test sites, and other military facilities. In addition, types of reconnaissance activities were also necessary into economic and agricultural capabilities, to measure the power of each country. Once upon a time, military reconnaissance was limited to facilities related to the army and navy. But, by the end of World War II, it has become necessary to analyze everything including the economic and industrial power of countries waging war. This trend was further extended after World War II, and severe intelligence struggles continued without an actual war. And this system of intelligence battles itself deterred an actual war. People assumed that there would be a third world war, but the extreme danger caused both parties to restrain themselves. In place, as wars by proxy, several international conflicts occurred in places which were strongly influenced by their previous suzerains, et cetera. And reconnaissance photographs were helpful in times when such international conflicts occurred frequently. So, secret reconnaissance flights were very active in the fifties. And it was when a U2 spy plane was shot down that it was decided to use another method urgently. Reconnaissance activities using satellites should be continued, but as it is a very delicate matter to investigate other countries beyond national frontiers, and there are places where the sovereignty cannot reach, like space. Reconnaissance satellites in those days were flying at incredible altitudes of between 150 and 100,000 kilometers. (Footnote: 150 km was the minimum altitude of a reconnaissance satellite and 100,000 km was the maximum altitude of a nuclear detection satellite.) These altitudes were out of reach of ground attack. The U2 was said to be shot down, but it was actually sabotage; some trick was set up when the plane left its base in Turkey, and it was forced to land in the Soviet Union. If a missile had been used, the plane would have been crushed into pieces. Perhaps it could not increase its altitude but fell gradually and was forced to land by an interceptor. The purpose might have been to capture the pilot as a witness. Then, in space, there is the impossibility of attacking and legal limits. This leads to discussions about how high into the sky the territory of a country extends. The discussions in those days talked about 100 km or 150 km. The reason why? The United States claimed that the height was 100 km and the Soviet Union said it should be 150 km. These were the limits of the altitudes of their satellites. Satellite efficiency fell at lower altitudes than these. So no reconnaissance satellites were flying lower than 100 km, except for special cases. So, when we consider the history of reconnaissance activities, we find that reconnaissance is not a unilateral action but one of bilateral agreement based on tacit understanding. Reconnaissance was conducted based on a confidential bilateral agreement between the United States and Soviet Union. Both of these parties assigned ICBM's, and surveyed each other by assuming the case in which their ICBM's were poised for attack. Then the two parties showed the results they obtained, how many ICBM's the Russians had and how many ICBM's the American had, to the other party. This became a bilateral agreement. It is, after all, the opening of information. They opened information while conducting reconnaissance activities. They showed all of the missiles in the silos in their missile launching sites. For example, if the covers of a silo were closed due to certain work, one party would call the other party to tell them "We can't see the inside of silo No. X, please open it". Such a thing happened very often. This took place from the fifties through the eighties.

[Tomita] The Soviet Union led the field in satellites, right?

[Sakata] After all, reconnaissance using airplanes was limited, so they decided in a hurry to use satellites. It was with Sputnik in 1957 that the first satellite was launched. The background of this launch was related to a conference for the International Geophysical Year held in Washington in October 1957. An idea of using satellites for earth observation was proposed at this meeting. Everyone thought that the United States would be the country to do it first. Contrary to expectations, however, the Soviet Union launched a satellite. In the very middle of a party, the Soviet Union frightened people by launching Sputnik. It was international propaganda. With the Sputnik shock, the United States, which had been boasting that its technology was the world's best, was confused because they were left behind by the Soviet Union. This became the trigger for the birth of NASA, which led to the rapid increase of America's challenge in space until it sent men to the moon. The launching competition started in around 1959. However, from 1957 to early 1960, the launching competition was composed of a continuous series of failures. Launches failed often at a rate of almost two failures per three launches. Most of the satellites launched one after another in this period were photographic reconnaissance satellites. Cameras were mounted in satellites and recovered later. Traditionally, the Soviet Union did not differ much in this basic policy. Some 50 to 60 percent of the satellites launched to date have been made in the Soviet Union. Particularly, the number of launches by the United States has been decreasing rapidly in recent years. This is because the longevity of U.S. satellites has been increasing. Another reason is that Russian intelligence gathering is still weighted more to photographic intelligence than electronic intelligence. As Russian intelligence is based on ground recovery, it is inevitably slow. They launch satellites and recover them after a short period. The shortest life is around a week; usually it takes from 30 days to as long as 3 months. On the contrary, the lives of U.S. satellites are increasing, and they fly for many years. In urgent cases, information can be downlinked through radio waves and film can be dropped in capsules which can be hooked and recovered by airplanes. Reconnaissance satellites are large in scale. I say large in two meanings. One is that they fly for long periods, carry a great deal of fuel for use in orbit changes, and have a lot of film with which to take pictures. The other is that they have long

ranges. This is why they have permanent surveillance capabilities. Soviet reconnaissance satellites feature the possibility of instantaneous launching. They can be recovered over a wide area and landed anywhere. Thanks to their long experience, photographic reconnaissance is advanced, and beautiful pictures can be taken with great certainty. The Soviet Union launches satellites easily. In the case of the Falkland Islands or on the frontier between Iran and Iraq, the Soviet Union launched a satellite immediately when they felt something was strange. The images acquired in this way were used very politically, by both the United States and Soviet Union. The most well-known episode happened at the end of a war between Israel and Egypt. They showed the photographic images and encouraged the Egyptians to stop fighting, telling them, "You are already beaten in this way, you should give up".

[Tomita] You mean that the utility value of reconnaissance satellites has increased, right?

[Sakata] Since 1960, the level of military use of photographic reconnaissance satellites context has increased greatly. On the other hand, their value has increased as an international strategy rather more than in military terms. This is an important point. According to the present concept, military satellites would be nothing if they simply gathered intelligence and could not be utilized as a means of applying international pressure. There has been a criticism on reconnaissance that people buy expensive aircraft and spend expensive fuel, but satellites are even more expensive. Criticism of satellite reconnaissance may be based on the data used not being open. I believe that reconnaissance should be conducted in such a way that the results can be reflected in international politics. Both the Soviet Union and United States have used them in very clever ways. If military satellites are to be leased, their purpose should not be limited to military use alone. Reflecting international politics, I feel that military reconnaissance would be meaningless until Japan has become capable of fully using the power of Japanese intelligence in the international community. Reconnaissance activities have become very common since the latter half of the sixties, largely led by the actions of the United States and Soviet Union. But, in the latter half of the seventies, satellite data has become available all over the world. In other words, when the first earth observation satellite was launched in 1972, the satellite observation data of the earth became available to anyone. The intelligence system which had been monopolized only by military satellites was made more widespread. This was an important change in the situation. At the United Nations in 1978, then French President Giscard d'Estaing expressed disapproval of the current situation in which the global developments were in the hands of the two superpowers, the United States and Soviet Union, proposing the creation of an international surveillance satellite organization as a third-party organ. This proposal was not dropped but shelved by the United States and Soviet Union. These countries combined to shelve it because they had been doing well in the two-country system and did not want to make things harder by the participation of others. The proposed organization was called ISMA (International Space Monitoring Agency). But Giscard d'Estaing did not give up. He decided to take action by Europe alone and created the RSMA (Regional Space Monitoring Agency). The group acting for it included France, Germany, the United Kingdom, the Netherlands, Sweden, and Denmark. In this action to monitor the international situation using satellites, we at Tokai University also joined and developed joint actions with the groups involved in ISMA and RSMA at the Europe Center (of Tokai University) in Copenhagen in 1980. This information exchange is still continuing today. It is because international exchanges in various fields are developed based on an international scope that we can view things from a relatively international viewpoint. We believe that intelligence gathering and information analysis should not be operations restricted to governments alone. The private sector should also participate in them. This is a critical point. If only the government possesses intelligence and keeps it confidential, a criticism against this situation is inevitable. To prevent this, governments should maintain exchanges with private organizations like us, and certain conflicts between different opinions should be accepted. Such a trend will take a concrete shape as the freedom of information.

Competition in Satellite Resolution

[Sakata] By the way, as the times changed from the seventies to the eighties, there was another factor bringing about a change in the situation. This was the change in satellite resolution. When the first earth observation satellite was launched in 1972, resolution was 80 m. This was an astonishing figure in those days. As dissatisfaction increased through long years of use, however, it was decided to improve resolution, which became between 50 and 80 m in the eighties. The resolution of the MOS-1 launched by Japan was 50 m, a figure exactly in the middle. It was launched in 1986. Then a satellite with 30 m resolution made a debut and, after the 30 m resolution continued for a while, France launched a satellite with 10 m resolution, the SPOT satellite. The eighties were a period of active competition in resolution between earth observation satellites. This has continued into the nineties. People are no longer satisfied with resolution of 10 m or 20 m. The time has come when it is should be less than 10 m. Recently, resolution below 10 m—such as 5 m and 2 m—has become common. The first point of this is the emergence of Russia following the collapse of the Soviet Union. Since Russia has a huge amount of data obtained from launching so many military satellites for more than 30 years, they realized last year that selling the data would make money. They have distributed samples all over the world. They have also sometimes sold data with a resolution of 3.7 m or between 7 and 10 m. They have also released sample data with a resolution of 2 m (with this level you can see very fine details of the Pentagon photographed from the sky). This was very shocking for the United States. In principle, the United States did not open military satellite data because everything would become clear upon inspection. After various discussions by Senate committees, however, it was decided to make the data public. But while the government was wondering if such intelligence could be made public or not, it was decided to rescind the related regulations, establish a department which sells public data apart from the military satellite data, and launch satellites for acquiring public data by the private sector. This started the space war for higher resolution. The present typical project is a project to launch satellites with 1 m class resolution by the private sector. The story is: As a

result of the reduction of military industry, the U.S. government recommended that businesses cooperating with the military invigorate themselves by even permitting them to make public some of their know-how, and companies including Lockheed started to take action, forming a few organizations for business in this field. With these changes in the world situation, one of the key factors is resolution. The capability of reconnaissance satellites lies in high resolution. Then, the reason why high resolution is critical is that they should identify such weapons as warships, tanks, and aircraft. Bases can also be identified easily. Before this were the missiles. These were first ICBM's but, as their strike probability increased, their size was reduced. It has now become necessary to be able to catch small and highly powerful ICBM's. For the degree of the possibility of reconnaissance to detect short range missiles, it is presently categorized into three levels: detectable, confirmation, and technical Detail. As for the specific details, the detectable level means around 2.5 m resolution for short range missiles. The confirmation level is 1 m and the Technical Detail level is less than 30 cm, according to a general standard. Then, for the limits to making the information public, 5 m resolution is almost meaningless militarily. Five-meter data had a certain value before, but now that certain data has already been known, a resolution of 5 m is useless. So Russia dared to set the resolution at 2 m. This was a decision based on international considerations. The United States finally made a decision backed up by economic considerations and set the opening limit resolution to 2 m or 1 m. This has altered the significance of military satellites. It was an important change in the course of these historical steps that, in 1990, we announced the results of our survey on the suspicion of the Yonbyong nuclear facilities that we had started to investigate in 1986. We did not have any special intention in doing so, but we just made it open in consideration of various factors. The information was spread all around the world. The reason for this was that, until then, military satellite data had not been made open to the public. Such data had often been leaked partially, but it had never taken the form of pictures. But we showed the visual directly. This shocked the entire world and, it's a mystery, but the picture we produced is still in use throughout the world. We produced the picture by synthesis by combining several pieces of data obtained with the French SPOT and Landsat satellites. The picture was not able to be seen like a movie. Now, since even a 10 m picture was so shocking, we pursued more thinking that it is the nature of human beings to want to know more details. After all, Russia was the only country which would open such data to us, so we discussed with Russia such matters as the sale of 7 m data by Russia and no sales of data on Russia and North Korea. Then suddenly, in May or June 1994, the Russians said they could provide the data. We knew that Russia had not provided the data in order to prevent pressure for such political reasons as their influence at a time when the North Korea problem was becoming extraordinarily critical. That they then said they could provide the data meant clearly that they had the intention to bring such pressure. So we started negotiations and first obtained 5 m data. We showed it in June through commercial TV networks. Later, after more negotiations with Moscow, we obtained 2 m data and presented it through NHK news. What we should note here is that, although reconnaissance with 1 m resolution is a great thing, both the United States and Soviet Union had already achieved 1 m resolution by the end of the sixties. Their resolution reached 30 cm or 50 cm in the seventies. It was already below 10 cm in the eighties. From the viewpoint of area, an area of 1 m square contains 100 times the amount of information in a 10 cm square.

Proposing International Inspection Satellite

[Tomita] Returning to what you said before, there is no intelligence value in using strategically information already held, right?

[Sakata] That's right, because everybody has it. It is pitiful that only Japan should buy such information. This may be quite shocking for those people doing so, but there has been no clear debate on it. What we should now start to consider is that we should increase the strategic rather than the tactical value of satellite intelligence. We must develop tactical intelligence ourselves. So we should not use such terms as military reconnaissance satellites and spy satellites. Rather, we should use such terms as international inspection satellites or international sensing satellites.

[Tomita] You said a resolution of 1 m is enough but, as such a value, doesn't smaller resolution provide better information?

[Sakata] As a tactic, we should launch low-cost, high-resolution satellites that are compact in size, stable, and capable of being launched at any time. But now things are inverted, and high resolution does not always mean usefulness. To study the global environment requires a large amount of data on everything. For example, it is necessary to measure carbon oxide gases and check the degree of pollution. Now, today's earth observation satellites have a very high level of information gathering capability. Speaking in the extreme, I would say that the high resolution of military satellites does not mean much.

[Tomita] Today we were able to hear your very interesting discussion, based on your own experience, regarding the importance of national-level intelligence capabilities. Thank you very much.

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